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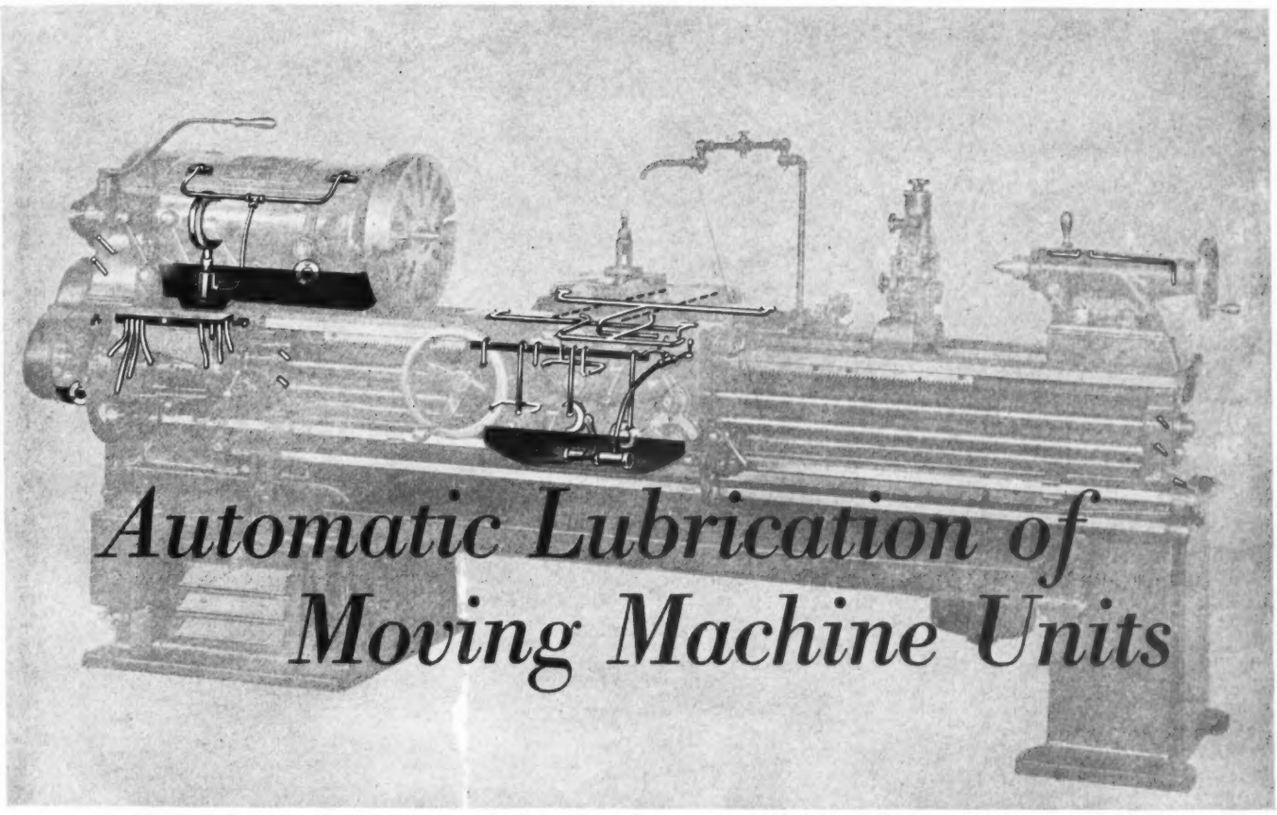


Automatic Lubrication of Moving Machine Units

Automatic Lubricating Systems for Moving Unit Mechanisms of Machine Tools Have Greatly Facilitated the Solution of the Problem of Dependable Lubrication

By F. M. HEWITT
Bijur Lubricating Corporation
Long Island City, N. Y.

MAINTENANCE men—whose mission in life seems to be largely to correct other people's mistakes—have long said, "A machine is as good as its lubrication." Because experience has proved that a single frozen bearing may cause an entire machine to be wrecked, the advantages of automatic lubrication are now recognized by the designing engineer. The assurance that no bearing will be forgotten removes a great deal of worry from the minds of the machine user.

Likewise, the need of correctly metered lubrication—that is, lubricant automatically metered to each bearing in the exact quantity required by its type, size, speed, and load—has made the designing engineer favorably inclined toward the centralized force-feed lubrication systems through which such metered lubrication can be adequately controlled.

Modern high-speed high-production equipment in which lubrication cannot be left to chance has made the need for dependable lubrication more urgent. This necessity is recognized by every designer; what he may not know is how simply even the most advanced types of centralized pressure systems for automatic metered lubrication can be applied. They are adaptable to practically any type of machine or operating condition. They are readily built into the machine without great additional cost. The maintenance savings that they effect make their installation a matter of economy; besides, comparative freedom from breakdowns minimizes the worries

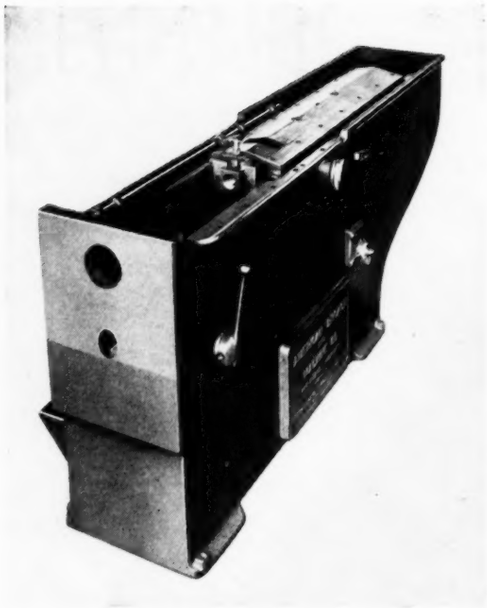


Fig. 1. Slide and Bed of American Hydraulic Broaching Machine Equipped with Bijur Automatic Lubricating System

of the production executive. In the present article, a number of applications of the Bijur lubricating system to several types of machine tools will be described.

In a horizontal hydraulic broaching machine built by the American Broach & Machine Co., during the cycle in which the broach slide travels to the limit of its stroke and returns, the lubricator pump operates twice automatically, under pressure, continuously metering the correct amount of oil to each bearing surface. The entire lubricating system is built into the slide itself; yet it is so inconspicuous that a casual examination would hardly reveal its presence. Fig. 1 shows the bed and slide of this machine. The slide is made up of two members bolted together. In the assembled position, they are a running fit on the stationary ways.

The automatic lubricating system consists of (a) a continuous type lubricator pump mounted on the upper slide casting and operated through a button; (b) an oil reservoir in the lower part of the broach slide; (c) an oil distribution line with a single feed-line leading to a six-way junction from which four branches of 5/32-inch outside diameter tubing lead to four meter-units, each serving a bearing surface. In larger sizes of broaching machines, a ten-way junction is employed, with eight branch feed-lines to eight bearing surfaces.

The arrangement for four bearing surfaces is shown diagrammatically in Fig. 2. The feed-line can be readily traced from the lubricator pump to the four meter-units. Drilled holes are provided to conduct the oil from the meter-units to the broach ways. The bottom way is lubricated chiefly by drainage from the upper surfaces. Check-valves in the meter-units prevent dripping and seepage from the lubricating system; the valves also maintain the system full of oil. Consequently, there is neither dripping of oil on the floor nor any lag in lubrication when the machine is started.

A cam dog, as shown in Fig. 3, is located on the stationary part of the machine, directly under the

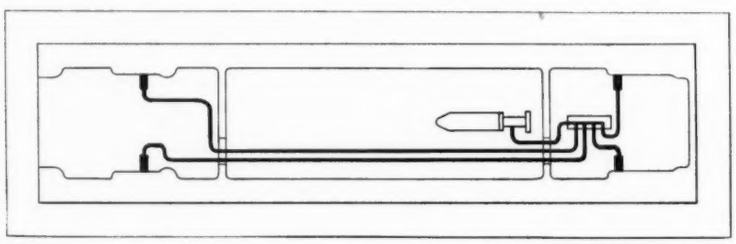


Fig. 2. (Upper View) Diagrammatic Plan of the Automatic Lubricating System Applied to a Horizontal Broaching Machine

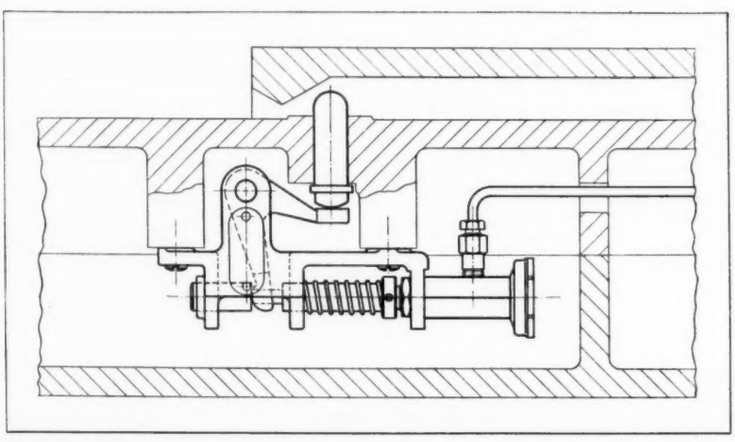


Fig. 3. (Lower View) Mechanism that Actuates the Lubricating Pump on the Broaching Machine

Fig. 4. (Right) A Giddings & Lewis Horizontal Boring, Drilling, and Milling Machine Provided with Automatic Lubricating System

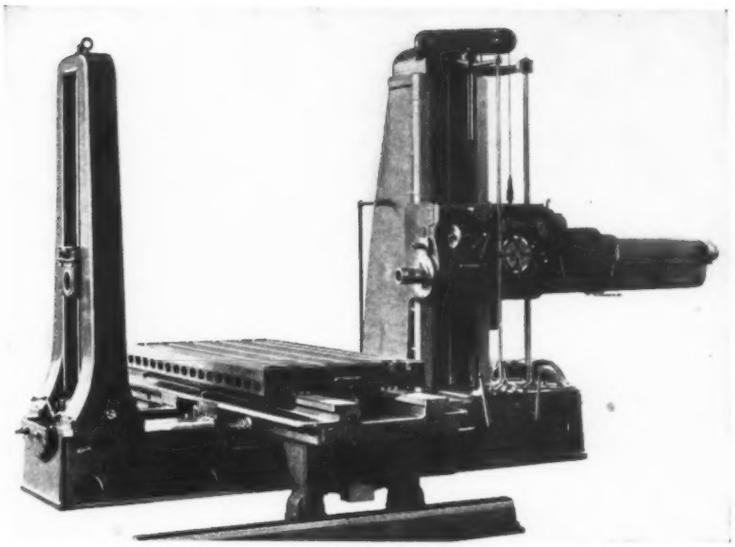


Fig. 5. (Below) Lay-out of the Automatic Lubricating System for the Giddings & Lewis Machine

protecting cover. This is the dog that actuates the pump twice during each cycle of the machine slide operation.

In the Giddings & Lewis horizontal boring, drilling, and milling machine shown in Fig. 4, an automatic lubricating system mounted on a moving unit is employed. The lubricator is mounted on the saddle, and is operated by means of a rocker arm and a shaft beveled on the end to form an actuating cam.

From a single junction, located approximately in the center of the saddle unit, the oil feed-lines pass to the meter-units serving the various bearings, which include two ways where the saddle bears on the bed; two ways where the table bears on the saddle; a longitudinal feed-nut; a cross-feed nut; and the cross-feed mechanism gears. The length of the saddle ways lubricated is 36 inches, and the width of the ways on the bed 8 inches. The total length of the table ways is 72 inches. Fig. 5 shows the distribution lines of the oil feed system.

Fig. 6 shows the hexagon turret and slide of a Warner & Swasey heavy-duty turret lathe. In this illustration, *A* is the oil reservoir, in which the lubricator pump is mounted; *B* is the rapid-traverse lever; and *C* is the rapid-traverse rod. The lubricating equipment is used for lubricating the bearings of the turret. The pump is of the continuous type, with a 1/4-inch piston having a 1/2-inch stroke.

The oil distribution system, as indicated in Fig. 7, consists of a single feed-line, two junction fittings, and four meter-units which automatically measure the oil to the four bearings—two surfaces on each

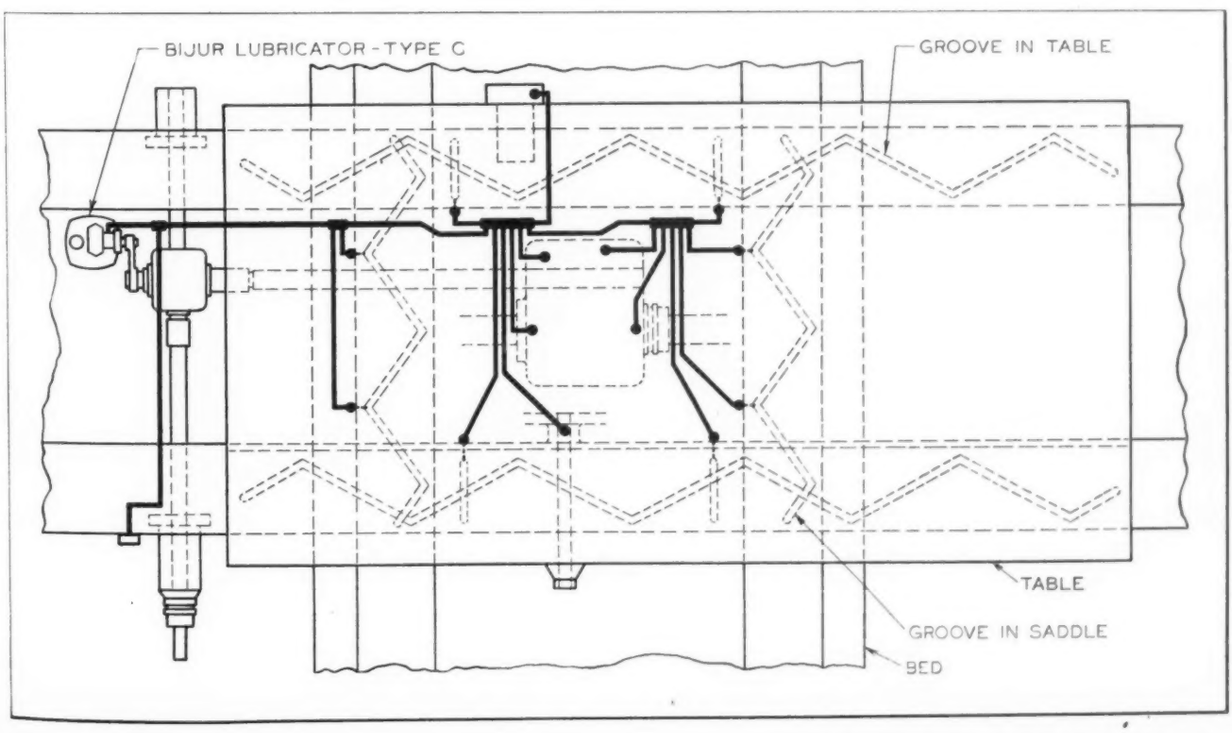


Fig. 6. (Right) Rear View of the Turret Carriage of a Warner & Swasey Heavy-duty Turret Lathe

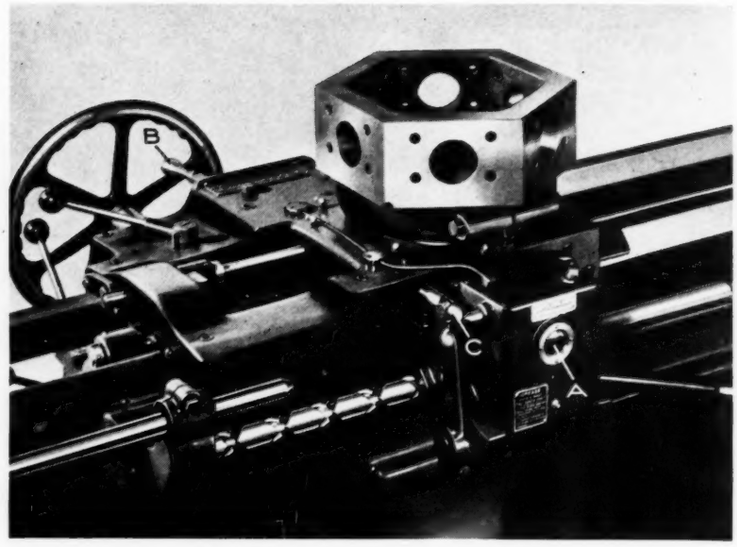


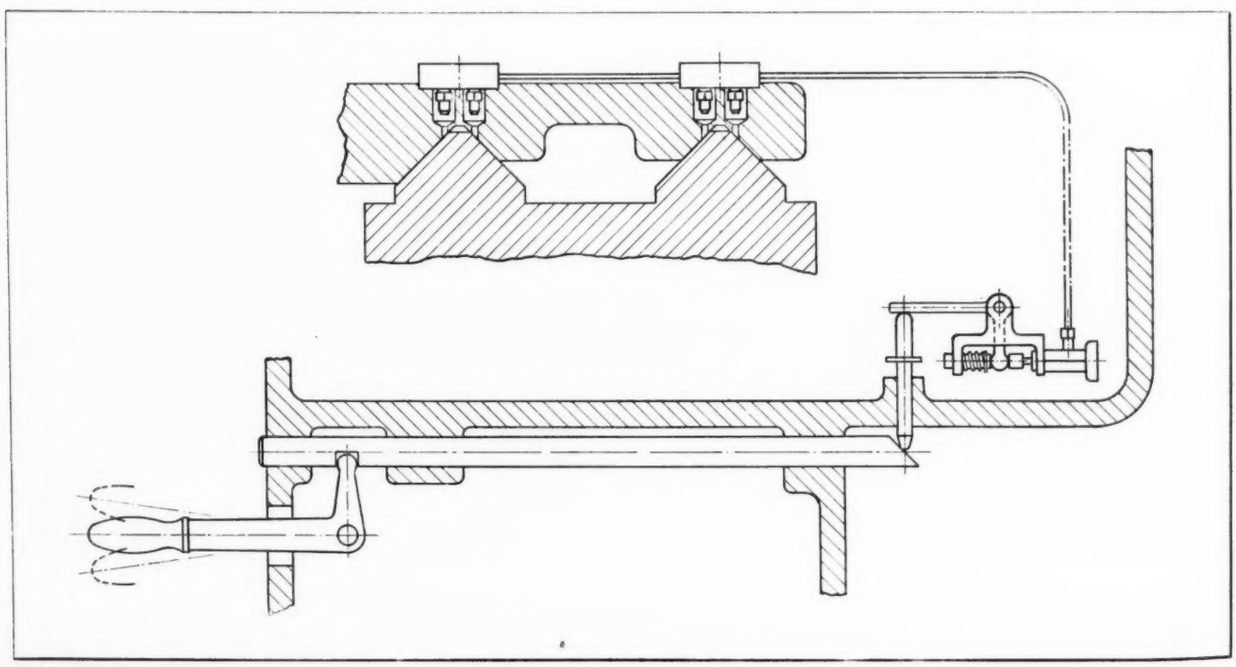
Fig. 7. (Below) Diagram Showing the Application of an Automatic Lubricating System to the Turret of a Lathe

of the two bed ways. The pump is operated by the rapid-traverse lever and rod, as also indicated in the diagram.

The operator, standing in front of the cross-slide carriage, pulls the rapid-traverse lever toward him, in order to move the turret toward the headstock; to move the turret away from the headstock, he pushes the lever away from him. The movement of the rapid-traverse lever is transmitted to the lubricator pump through the rod. When the rapid-traverse is in neutral, the pump-operating mechanism is also in a central or neutral position, as shown. When the lever is shifted from neutral in either direction, the lubricator pump is actuated, the stroke being 1/4 inch. If the rapid-traverse is shifted from the extreme position in one direction to the extreme position in the other, the pump stroke is 1/2 inch. Every time the pump piston is operated through a 1/4-inch stroke, the oil delivered by each meter-unit is approximately one drop. "Flooding" the ways when the power is off is done by simply moving the rapid-traverse lever back and forth.

For lubricating the cross-slide carriage, a continuous type pump having a 3/16-inch piston with a 1/2-inch stroke is utilized, as indicated in Fig. 8. In this illustration, *A* is the cross-feed screw, and *C* indicates the shaft on which an eccentric pin is provided to operate the lubricator pump mounted in reservoir *E*, at the top of which is located oil-filler *D*. Fig. 10 shows the method of mounting the pump horizontally in the reservoir. The motion of the eccentric pin oscillates arm *A* and, through rocker shaft and arm *B*, operates the lubricator pump.

The oil-line from the lubricator runs through a "through adapter" to a five-way single junction, as indicated in Fig. 9, which is mounted on the car-



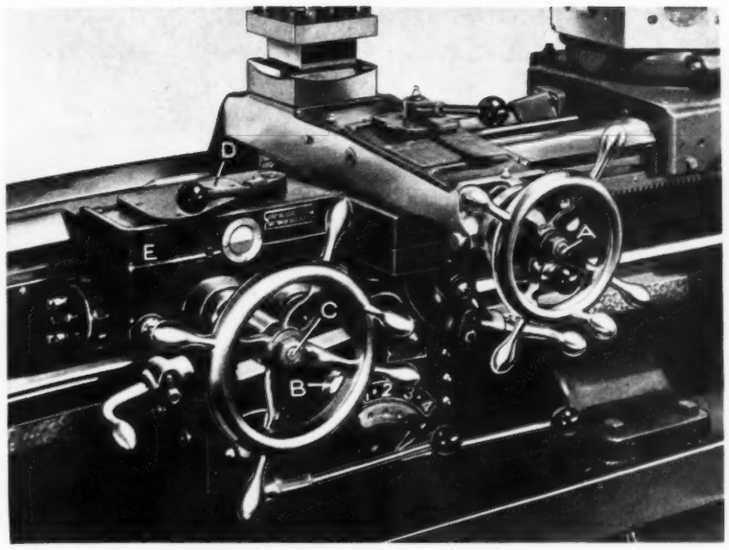
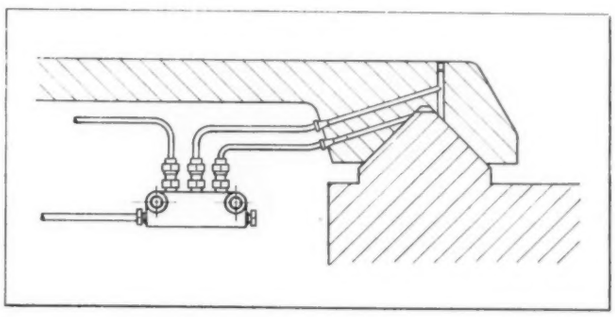


Fig. 8. Cross-slide Carriage of a Heavy-duty Turret Lathe Equipped with an Automatic Lubricating System

riage casting almost directly under the cross-feed screw. Since the carriage rides on only one bed way, two meter-units are sufficient, each lubricating one of the two sides of the bed way. Another meter-unit keeps the worm pocket filled. A slotted-head plug permits draining the reservoir when required.

The pump is operated through 1/2-inch stroke for each 1 1/4-inch movement of the carriage along the bed. Each way surface, therefore, receives approximately one drop of oil for every 1 1/4 inch of carriage movement. Manifestly, this system of lubrication entirely prevents the consequences due to insufficient lubrication of the sliding bearings of the turret lathe, such as might result from the use of hand oil-cup lubrication.



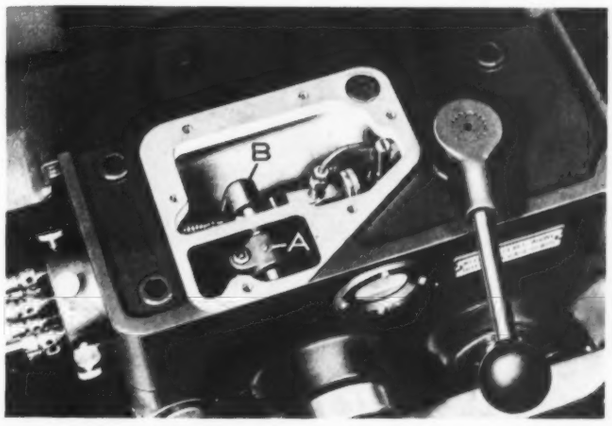
A final example of moving machine parts carrying their own lubrication system may be observed in the Baker Bros. multiple-head boring machine shown in Fig. 11. As this machine has an output of 360 parts an hour, the slides are obviously subjected to heavy loads. The vertical slides for the head are approximately 7 1/2 inches wide by 48 inches long. The moving head carries an automatic lubrication system, the pump and reservoir unit being visible at the very top of the slide. While in this instance the unit is installed high on the machine, it should be noted that since the Bijur system depends on forced feed and not gravity, the pump and reservoir can be placed at any desired level.

The 3/16-inch diameter pump piston has a 1/2-inch stroke; the oil reservoir has a capacity for eighty hours of operation without refilling. The pump is actuated by the head movement of the machine, and the system lubricates the slides continuously with a metered oil film.

Whether a machine unit is movable or stationary,

Fig. 9. (Above) Diagram Showing the Bijur System Applied to the Cross-slide Carriage of a Warner & Swasey Turret Lathe

Fig. 10. (Right) Actuating Parts of Lubricating Pump Mounted in the Oil Reservoir of the Lubricating System



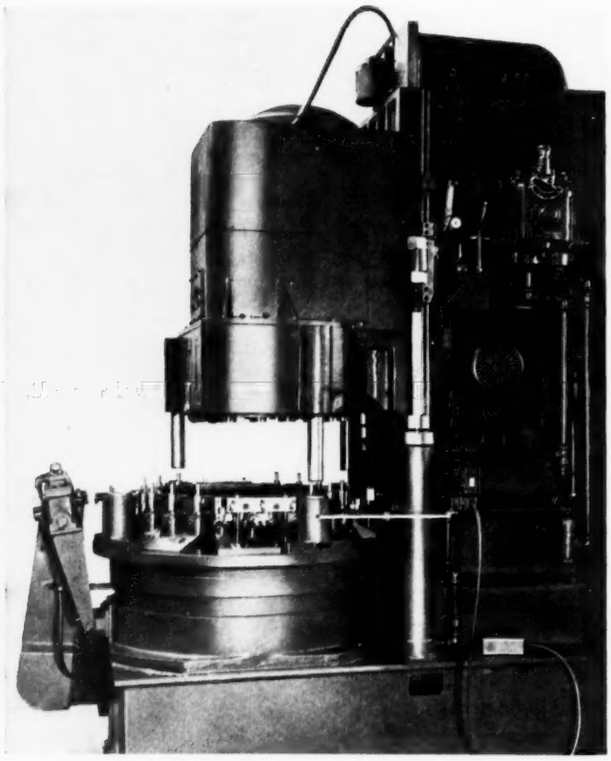


Fig. 11. A Baker Bros. Multiple-head Boring Machine Equipped with Automatic Lubrication for the Sliding Head

a properly designed centralized force-feed automatic lubricating system can be applied to take care of any number of bearings. The dependability of the meter-unit is, of course, the very heart of the system. The meter-unit employed in the systems here described consists of a filter, a meter chamber, and a check-valve at the outlet (see Fig. 12). The rate of the metered oil flow, which is predetermined, is controlled by the amount of clearance between the metering pin and the walls of the metering chamber. No other regulation is necessary to maintain a uniform feed to each bearing.

Experienced machine shop superintendents are beginning to demand advanced methods of lubrication in machine tools. They feel that the saving in maintenance expense fully justifies the slight extra cost of providing the best lubricating means.

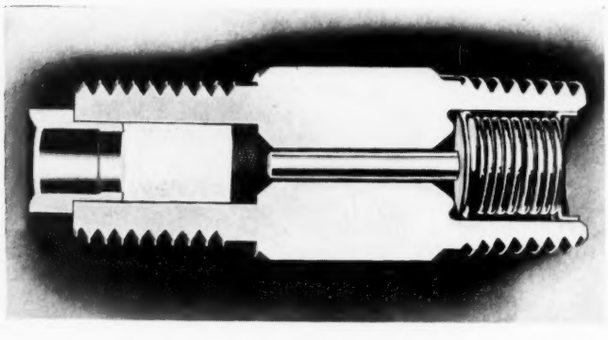


Fig. 12. Cross-section of the Bijur Meter-unit

Report of the President's Committee on Trade Unions in Sweden

In the report made to the President by the committee that investigated labor union conditions in Sweden, it is briefly mentioned that, according to the agreements between labor unions and employers in that country, the employer has the right to engage and dismiss workers, and to employ workers who belong to any union, or unorganized workers, according to his own discretion. In other words, while almost all the workers are organized in trade unions in Sweden, the closed shop is not recognized.

This difference in labor union conditions in Sweden and the United States possibly needs more emphasis than was given to it in the report. According to a concise statement on industrial relations in Sweden by Joseph Mead, published in the *Economic Forum*, collective agreements between a member of the Employers' Association and a labor union, according to the rules of the Association, must always include a stipulation to the effect that "the employer has the right to engage and dismiss workers at his discretion, to direct and distribute the work, and to employ workers belonging to any union, or unorganized workers."

The Employers' Association has successfully maintained this rule without qualifying it in any way. This regulation is included in all the collective agreements and upholds the principle that the employer has a right to control the production and personnel of his plant.

Another point of considerable interest pertaining to the labor union conditions in Sweden is that while practically all workers in the trades are members of a labor union, both labor unions and employers have constantly endeavored to keep the government out of labor union matters. Both union leaders and employers prefer to settle such differences as may arise by negotiations with one another, without government interference.

Furthermore, both the unions and the individual members are legally responsible for acts of the union and for living up to their agreements. This has prevented so-called "fake unions" and "racketeering" agitators from being active, since both the leaders and the workers could be held responsible for breaking their contracts.

What legislation there is has been made with the view to assuring that law and justice would be upheld. Because of these safeguards, both labor and employers know that their difficulties can be settled "within the law," and experience has shown that they prefer this method of settling their difficulties to one that leads to practically civil warfare.

* * *

The oldest employe in the automobile industry is believed to be M. J. Murray of the telegraph department of the Oldsmobile plant at Lansing, Mich., who, at the age of ninety-two, is still active in his work.

Perforating and Blanking Dies for Small Ornamental Parts

Seventy-Two Perforating Punches are Grouped in an Area of 3 Square Inches in a Die Used for Producing a Small Ornamental Part

By M. J. GOLDSTEIN

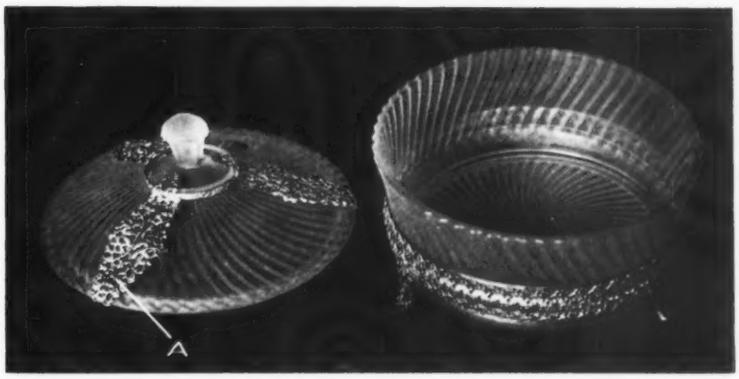
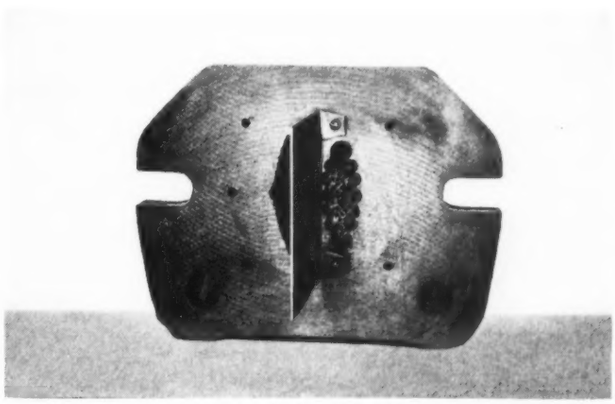


Fig. 1. Candy Dish with Gold-plated Ornamental Parts Produced in Press Dies

IF ornamental metal parts such as are used on the candy dish shown in Fig. 1 were produced individually by hand engraving, the cost of the finished product would be prohibitive, or so high that sales would be restricted to a very small group of customers. However, by employing dies to perforate, blank, and emboss these parts, the cost is brought to a point where the product can be profitably manufactured for wide distribution.



In making dies for producing parts such as shown at *A*, Figs. 1 and 5, the toolmaker must exercise considerable skill as an engraver, as well as a diemaker. This part is first perforated and blanked to the shape shown at *B*, Fig. 5, after which it is embossed and then assembled with other ornamental parts, as shown in Fig. 1, by means of spot-welding. The parts are then given a 24-karat gold-plated finish. The embossing of part *A*, Fig. 5, is done on a toggle embossing press employing a pressure of about 75 tons.

Although part *A* is only 3 inches long by 1.235 inches wide, there are punched within this space seventy-two openings of different sizes and shapes. The perforating and blanking operations are performed in the two-step die shown in Figs. 2 and 3, the stock being fed from left to right. Naturally, a great amount of care is required in making the perforating section of the die, especially in filing the clearance.

Some idea of the work entailed in making this die may be obtained from the fact that the smallest hole required was drilled with a No. 52 drill, while the largest was drilled with a No. 31 drill. The drilled holes were filed to the finished shape of the perforations shown in the blank at *B*, Fig. 5. The die blank is 3/4 inch thick, and the openings are made about 0.008 to 0.010 inch larger at the back than at the

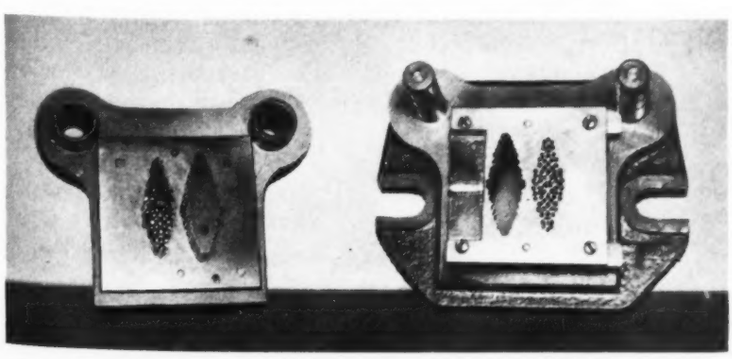


Fig. 2. (Above) Under Side of Perforating and Blanking Die, Showing Plate for Guiding Work and Piercings into Separate Boxes

Fig. 3. (Left) Upper and Lower Members of Die Used to Perforate and Blank over 100,000 Pieces Like the One Shown at B, Fig. 5

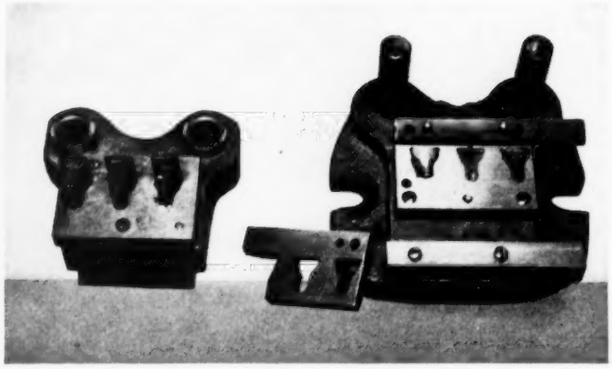


Fig. 4. Die Used to Emboss and Blank Pieces D, Fig. 5, from Scrap E

face of the die. This gives sufficient clearance to permit scrap to pass through the die easily, and yet does not weaken the wall structure.

The steel used in making this particular die was Ackerland "Green Label." In making the die, the stripper and punch plate were fastened to the die by dowel-pins and screws, and the positions of the holes transferred by drilling, after which the holes were rough-filed to within a few thousandths of the finished sizes. The punches are 1 1/2 inches long and were made from drill rod. They were hardened and drawn to a purple-blue color, kerosene being used for quenching in the hardening operation. The stripper and punch plate, each 3/8 inch thick, were again assembled on the die, after which each punch was carefully sheared through the assembled members.

No further work was done on the punch plate, but the holes in the stripper were enlarged about 0.001 inch. The blanking part of the die, being of the usual construction, requires no description. The completed die has produced over 100,000 pieces up to the present time without requiring grinding. The stock or material used for part *A* is 22-gage (0.025 inch) brass, 3 1/2 inches wide. The bottom view of the die, Fig. 2, shows the separator plate attached to the under side of the die. This plate serves to direct the blanks into one box and the scrap from the perforating die into another.

The view at *E*, Fig. 5, shows how the scrap stock *C* is used in making the small embossed leg *D* for products similar to the candy dish shown in Fig. 1. The die used for this operation is shown in Fig. 4. A diagrammatic lay-out of this die is shown in Fig. 6. The metal scrap is fed into the die from right to left. At the first step the part is embossed. At the next step it is blanked, except for a small notch shown at *Z*, which serves to hold the blank

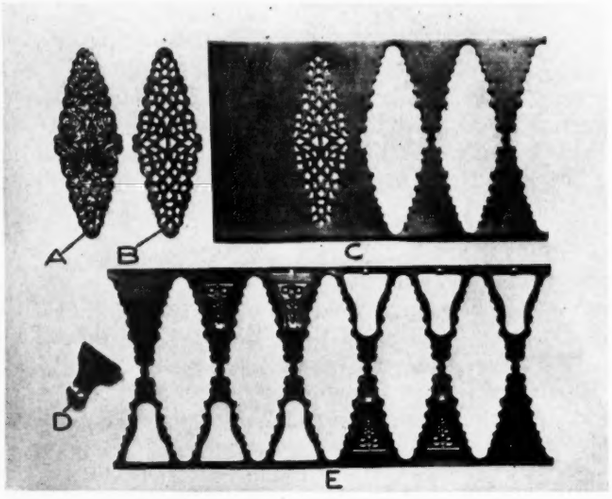


Fig. 5. Ornamental Parts and Scrap Stock from which Parts were Blanked by Dies Shown in Figs. 3 and 4

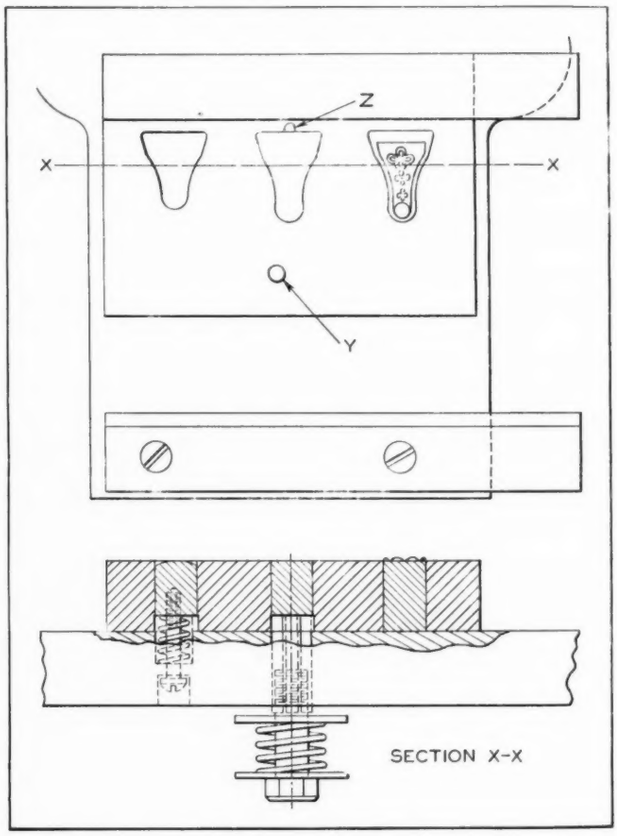


Fig. 6. Diagrammatic Lay-out of Die for Embossing and Blanking Part D, Fig. 5, Utilizing Scrap Stock as Shown at E

in the strip, a pressure pad being used to force the blank back into the strip. At the next step the notch at *Z* is cut off and the foot on the piece is formed. In the final movement of the strip, the foot is carried from the die. The locating stop at *Y* is an extension of one of the dowel-pins.

* * *

More than 40 per cent of the 75,000 employes of the General Electric Co. have been with the company for ten years or more. The average annual income of the employes in 1937 was the highest in the history of the company.

Slab and Progressive Broaching

By JOHN MARKSTRUM, Chief Engineer
Continental Division, Ex-Cell-O Corporation, Detroit, Mich.

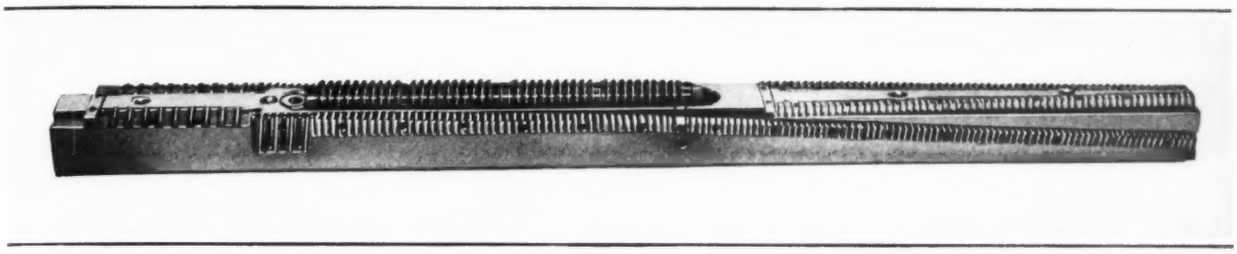


Fig. 1. Sectional Broach 7 Feet in Length, Made up of Broaches Designed on Both the Slab and Progressive Broaching Principles

WITH the increased application of broaching during the last few years to the finishing of iron castings, a new broaching principle known as the "progressive" or "generating" method has been developed which is used in combination with the common "slab" method. In the slab method, as everyone familiar with broaching knows, each broach tooth cuts the full width of the surface being machined, and each tooth is slightly higher than its predecessor, with the result that every tooth takes a light cut over the entire width of the surface.

In the progressive method, on the other hand, the broach teeth are much narrower than the surface to be finished. The line of teeth is inclined at an angle with respect to the length of the broach, so that the entire width of the work surface is machined as the broach is fed its full length past the work. Also, in this broaching method, each tooth takes a cut of full depth, so that the work surface is finished at one pass of the broach.

A sectional broach designed on both the slab and the progressive principles for machining the half-bore and lock seats of the main crankshaft bearings in an automobile cylinder block is shown in Fig. 1. The entire broach is nearly 7 feet long, and is used on a horizontal machine. On the upper side of the broach at the right-hand end will be seen broach sections designed on the progressive principle. These sections are arranged in the form of a vee for progressively broaching surfaces *A*, Fig. 2, which form the parting face of the crankshaft bearings. Surfaces *A* are broached the full width by the time that the left-hand ends of these broach sections complete their passage across the work.

On each side of the broach at the right-hand end are additional broach sections that cut on the progressive principle. These broaches take nibbling cuts along sides *B* until they meet the shoulders of the narrow surfaces *C*. Then follows a series of broach sections which finish surfaces *C*, and immediately in back of these is a short section with slightly longer teeth that takes light slab-broaching cuts to shave surfaces *B* their entire width.

On top of the broach in back of the progressive broach sections that machine surfaces *A*, there are four half-round sections which finish the half-bearing *D* by the slab method. At the extreme left-hand end of the broach on the top are sections for taking light finishing cuts across surfaces *A*, also by the slab method. Through the use of properly designed tools, cast iron can be broached to a good finish and in true planes, as is required for the joint surfaces of mating parts. Whether the slab or the progressive broaching principle should be adopted for finishing a surface depends upon individual conditions. Slab broaching, however, must always be employed when the surface to be machined is so wide as to prohibit progressive broaching because of the excessive broach length that would be required.

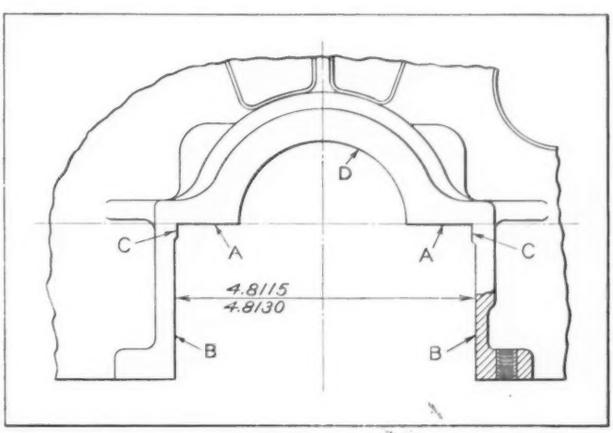


Fig. 2. Diagram Indicating the Various Surfaces on an Automobile Cylinder Block that are Machined with the Broach Shown in Fig. 1

Hydraulically Operated Remote Controls

By ALFRED WASBAUER

THE application of hydraulic mechanisms to the operation and control of machines and various types of equipment is constantly increasing, and machine designers generally are becoming better acquainted with the possibilities of hydraulic power-transmitting systems. Hydraulically actuated pistons and link mechanisms such as described in this article are well suited for the remote control or operation of machines of various types.

The diagram Fig. 2 shows the arrangement of a remote control for a large hydraulic piston served by a constant-delivery pump. This system is designed to control the rate and direction of advance and the position of the piston *E* in the cylinder without developing back pressure. In this installation, *F* is a constant-running, constant-delivery pump; *G* is a control panel or desk at a distance from the work where the cylinder is located; *H* is the control element; *I* is a control knob; *J* is a reference dial; *K* is a hydraulic link or unit composed of a cylinder and a rack *L* which engages a pinion *M;* and *N* is the oil tank which is located within the desk or at some other convenient place.

The control element *H* is shown in cross-section in Fig. 1. It comprises a hydraulic rack *O* similar to the rack *L*, Fig. 2, which engages a follower sleeve *P*, to which is attached the reference dial *J*. Within the follower *P* is a pilot valve *Q* controlled by the knob *I*. The valve *Q* has two sets of longitudinal channels *R* and *S*. The intake channels *R* and exhaust channels *S* connect with corresponding sets of ports in the follower *P*. These ports open into the circular channels shown by the cross-sections *A–A* to *D–D* of the housing *T*.

With the valve *Q* and the follower *P* in the relative positions shown in section *A–A* to *D–D*, the oil has a clear passageway from the pump through line *U*, Fig. 2, intake section *A–A*, channels *R*, exhaust section *B–B*, and channels *R*, Fig. 1, and back to the tank *N*. When the valve *Q* is rotated to the right or left, the channels *R* are blocked in the section *B–B* and a set of ports in sections *C–C* and *D–D* is opened to communicate with the work cylinder, the work piston moving to the right or left according to the direction in which the valve is rotated.

The volume and pressure of the oil admitted to the work cylinder varies according to the extent to which the exhaust and intake ports are opened, the full capacity of the pump being delivered to the work piston only when the ports opposed to channels *R* in section *B–B* are entirely closed, and concurrently when the corresponding ports in sections *C–C* and *D–D* are wide open. With this construction there cannot be any back pressure on the pump, since only as much energy as the work piston requires to do its task is supplied.

A movement corresponding to that of the work piston is transmitted at a reduced ratio to the hydraulic rack *L*, Fig. 2, by the pinion *M* and the gearing shown. The oil displaced by the hydraulic rack *L* displaces, in turn, the hydraulic rack *O* geared to the recording dial *J* on the control panel *G*. The two ball checks *W* in the valve *Q* automatically maintain the neutral relation between the valve and the follower. The grooves at *X* collect the oil which tends to escape along the walls of the valve and follower and return it to the tank through line *Y*.

Remote Control for Large Hydraulic Piston

In Fig. 3, is shown a remote control system for a large hydraulic piston served by a variable, reversible delivery pump. This system is designed to control the rate and direction of advance and the position of the piston *A* in its cylinder. The motor-driven, variable-speed reversible delivery pump *B* is controlled by the gear segment *C* in engagement with the hydraulic rack *D*, the latter being linked by tubing to a similar hydraulic rack *E* on the control panel *F*. The movement of the work piston *A* is transmitted at a reduced ratio to the hydraulic rack *G* linked by tubing to a similar rack *H* on the control panel. The enlarged section *X–X* shows the construction of the control element. The pointer *I* registers the direction and rate of discharge of the pump or the direction and rate of advance of the work piston *A*.

The dial *J* revolves in synchronism with the movement of the work piston *A*, the movement being registered on the panel. Thus, if the established proportions permit the dial to make one full turn for one full stroke of the work piston, the position of the latter will always be indicated on the control panel, and the dial can be graduated to suit the installation. The knob *K* operates the hydraulic rack *E* which, in turn, transmits its motion to the rack *D* through the displacement of the oil in their respective cylinders. This principle of control can be applied to the steering of ships, as well as to the control of machines of many types.

Remote Control for Semi-Automatic Operation of Hydraulic Piston

A remote control for a large hydraulic piston served by a variable, reversible delivery pump arranged for a semi-automatic cycle, including starting, progressive advance, uniform rapid return and stop, is shown diagrammatically in Fig. 4. The

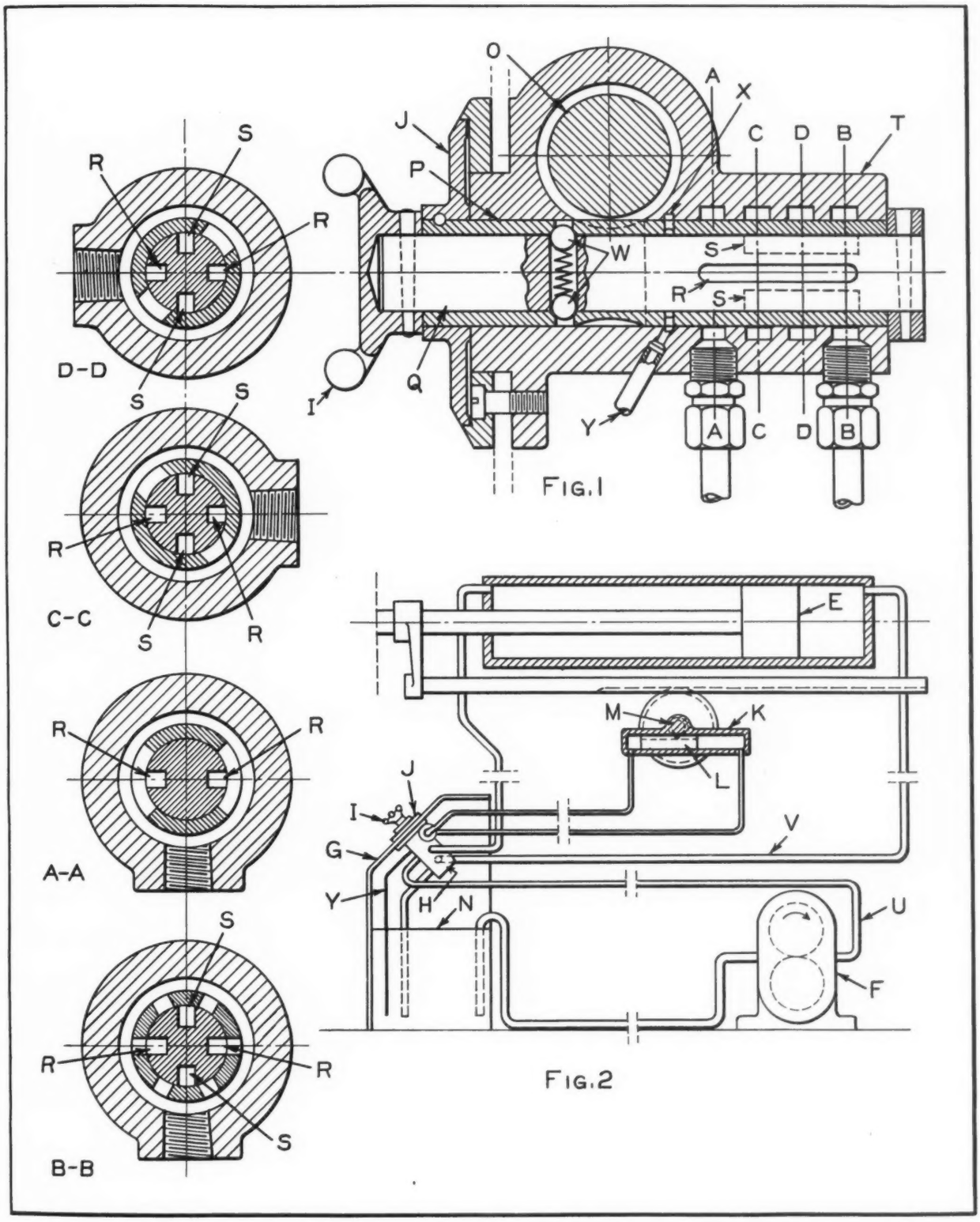


Fig. 1. Control Unit H of Hydraulic System Shown in Fig. 2. Fig. 2. Hydraulic System in which the Direction and Rate of Movement of the Work Piston E Driven by Pump F are Governed by the Remote Control Unit H

pump used in this installation is the same as the one used in the system shown in Fig. 3. The rate and direction of the pump discharge are controlled by the hydraulic rack *L*, linked by tubing to a similar hydraulic rack *M*. The movement of the work piston *N* is indicated in the reduced movement by the hydraulic rack *O*, linked by tubing to the hydraulic racks *L* and *M*. The racks *L* and *M* have the same total movement, but twice the area of the rack *O*, so that a full stroke of the latter rack will cause only one-half a stroke of either rack *L* or *M*.

With the control set as shown in Fig. 4, the sys-

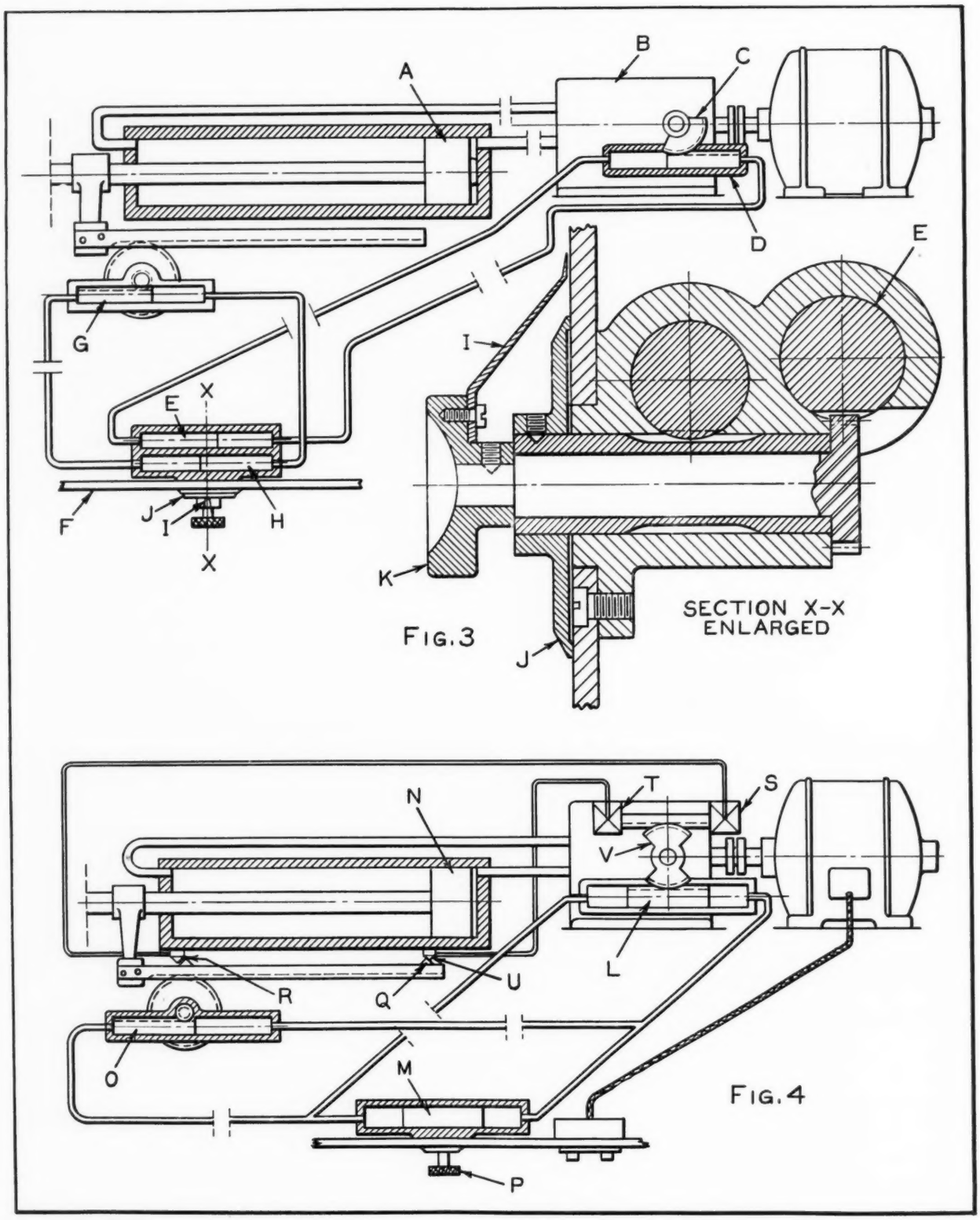


Fig. 3. Remote Control for Large Hydraulic Piston. Fig. 4. Remote Control System for Semi-automatic Operation of Hydraulic Pistons

tem is in the neutral position. To set it in motion, knob *P* is turned counter-clockwise, causing the rack *M* to move to the left. The oil displaced cannot shift rack *O*, which is held by the inertia of the work piston and its actuating mechanism, and so serves to shift rack *L* to the right, thus setting the pump for maximum delivery.

The work piston then begins its advance at the maximum rate, but immediately on beginning its movement, it shifts rack *O*, and since rack *M* at

this moment is at the extreme left position, the oil displaced by rack O can only shift rack L toward the neutral position of the pump. Since the capacity of cylinder O is one-half that of cylinder L, the pump neutral point will only be reached by rack L when the work piston N is at the end of its course. Before this occurs, however, the dog Q will have reached the contactor R, operating solenoid S to shift rack L clear to the left position for obtaining full pump delivery in the reverse direction.

The solenoid S will remain energized during the full return stroke of the piston N or until the dog Q cuts off the solenoid S and energizes the solenoid T through button U. When solenoid S operates to shift rack L to the extreme left, rack O is at the extreme right and cannot move because of the inertia of the connected parts; so the oil displaced by rack L will return rack M to its central position. As rack O moves to the left during the return stroke of the work piston N, the rack L is held stationary by the solenoid S, so that the rack M moves to the extreme right.

When, at the end of the return stroke, the solenoid T operates to bring the rack L and the pump to the neutral position, the rack M will also resume its neutral position, ready to begin the next cycle. It will be noted that the control knob P can be operated during the work stroke to reduce the delivery of the pump or reverse it if a false start is made, but it cannot be used to increase the volume of oil delivered. An adapter can be connected to the gear segment V to regulate the maximum delivery.

In illustrating these three systems of remote control, the object has been to make clear the principle of operation and to show in schematic form the variety of controlling movements obtainable with hydraulic equipment. All sorts of variations will occur to the designer. The equipment shown in Fig. 4, for instance, could easily be arranged to give the work piston a uniform rate of advance for a part of its stroke and a variable and progressive rate thereafter. In the case of the system illustrated in Figs. 1 and 2, the valve Q could be connected to a cam for controlling a complete cycle of motions or it could be driven by a clock mechanism to obtain an extremely slow measured movement.

Using "Machinery's" Pages as an Aid in Teaching

By M. F. FOSS, Instructor Mechanical Drawing
Washington High School, Washington, Pa.

IN our mechanical drawing and shop courses, we have found it advantageous to use the pages of MACHINERY as teaching material. MACHINERY is available in our shop library and has proved an aid in arousing the interest of the students.

As each issue of the publication arrives, the instructor makes up a question sheet and gives a copy to every student. The question sheet provides space for the student to letter his answer, or where necessary, to illustrate with a sketch. The completed sheet is checked and graded the same as any class assignment. The questions cover both the advertising and reading pages in the magazine. This procedure serves to acquaint the student with mechanical practice, new developments, and the machines and tools used in modern shop work.

The questions asked may be judged from a few examples. For instance, reference is made to an advertisement on a certain page, illustrating an object made from a non-metallic material. The student is asked to name the material, the object made from it, and to indicate the name of the general group to which this non-metallic material belongs. In another case, an advertisement of screws is referred to. The questions asked are: "Who makes these screws?" "What advantages are claimed for them?" "What classes of screws are available of the type advertised?"

The student is asked to read articles in order to answer specific questions. An article on die design requires answers to the questions: "What are these dies used for?" "Can you explain how these dies work?", etc.

In another instance, an article describing a newly developed metal alloy is referred to. The student is asked to mention the subject of the article, who developed or invented the alloy, who manufactures it, and where the manufacturing plant is located. He is also asked how many different types of this metal are made; what is the range of their tensile strength; and how this tensile strength is measured. The last question requires the use of a text-book, and this is noted on the question sheet.

Another article explains how the weight of jigs and fixtures has been reduced by welding. The student finds out how much was actually saved in weight and in the cost of the drill jigs and milling fixtures described. As a general rule, about a dozen advertisements and articles are thus picked out from each number of MACHINERY.

Several interesting results may be recorded. The students have developed a more thorough reading habit than was the case when the magazine was merely placed on the library shelves. Questions are asked that require reference to text-books and standard handbooks. This gives the student some idea of how he would have to go about finding information if he were actually engaged in shop engineering work. Several students have become interested in engineering courses through this compulsory reading. At the annual shop exhibit, some of the completed question sheets are placed on display.

Unusual Machine Tools Built by Welding

At the Plant of the Le Tourneau Company in Peoria, Ill., May be Seen Some Unusual Machine Tools Built Entirely by Welding

By G. G. LANDIS, Chief Engineer
The Lincoln Electric Co.
Cleveland, Ohio

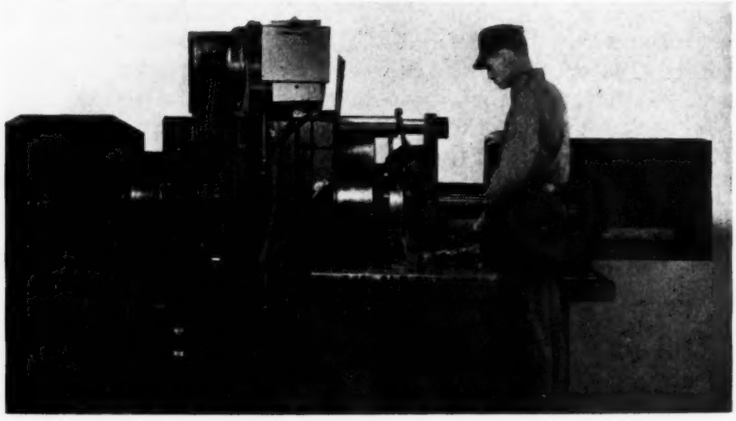


Fig. 1. An Arc-welded Lathe Known as the "Tournomatic" which Uses Any Number of Cutting Tools from One to Ten

A LATHE that would usually require months to build which is constructed and placed in operation in two weeks; a hydraulic press of a type considered impracticable to build by any method of construction, actually operating in less than a week after starting to build it; a boring mill placed in operation in one-third the time ordinarily required—such machines, which may be seen in operation in the plant of R. G. Le Tourneau, Inc., Peoria, Ill., emphasize the progress made in the construction of equipment by electric welding.

The Le Tourneau company is reputed to be the world's largest manufacturer of tractor-drawn earth-moving equipment. It is not a mere coincidence that these welded machine tools should have been produced in the plant of this company, because, for over ten years, this concern has used electric arc welding in the manufacture of its own product to the exclusion of other methods. The method used in constructing the machines to be described was the shielded arc process of welding, with "Fleetweld" electrodes, as developed by the Lincoln Electric Co., Cleveland, Ohio.

The machine shown in Fig. 1, termed the "Tournomatic," is actually a combination machine tool. Primarily it is a lathe, the base of which is a substantial rectangular arc-welded steel structure with a machined top. On this are mounted separate box-like power units for the chuck and the tools. Each unit contains its own electric motor and gear mechanism. A 15-horsepower motor drives the air-controlled chuck. The cutting tools, of which there may be any number from one to ten, are operated from the smaller power units.

In each separate unit, the cutting tools are mounted on the end of a 7-inch diameter spline shaft which is moved in and out of its rectangular housing by a 1/4-horsepower motor operating through a train of gears. The power units or boxes have a cover or door that is tap-bolted to permit access to the interior mechanism. Modifications in the chuck arrangement readily adapt the machine to different types of work. Because of the rapid, precise production possible with this machine, several have been built for use in the factory on a variety of jobs.

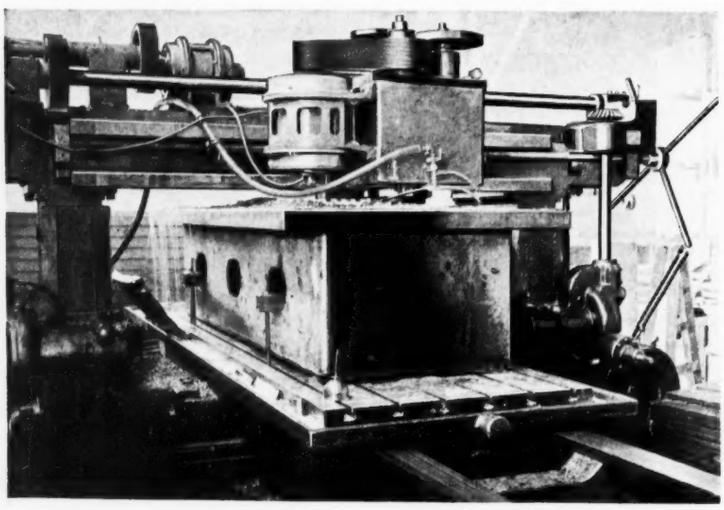


Fig. 2. The Arc-welded Base of the "Tournomatic" being Machined

The base of the machine, as indicated in Fig. 2, is arc-welded from 5/8-inch plate on the sides and ends, with a 1-inch plate at the bottom and a 3-inch thick slab at the top. There are interior reinforcements of 5/8-inch plate. Elmer Isgren, plant superintendent, who had charge of the building of the machine, states that the total construction time

for the entire machine was 202 1/2 man-hours, of which 30 man-hours represented drafting time, 20 man-hours plate-cutting time, 2 1/2 man-hours plate-forming time, 50 man-hours welding time, and 100 man-hours machining time. The total cost of the welded machine is estimated at one-third that of a machine built by conventional methods.

The second of the three machines referred to—a hydraulic press, shown in Fig. 3—exemplifies still more the simplicity of arc-welded construction. The remarkable feature is the piston and cylinder construction. Here we simply have two cylinders, one inside the other, made from a steel plate rolled into a cylindrical shape and welded. The piston-head is a piece of 3-inch slab, arc-welded to the piston wall.

The construction of the piston-head emphasizes the freedom with which changes can be made in welded designs. The original head, 1 inch thick, was found insufficient and was replaced by one 2 inches thick simply by cutting out the first one and welding on the heavier one. A second change was made in the same manner, replacing the 2-inch by the final 3-inch head. The seal between the piston and the cylinder is provided by packing, held by a steel ring bolted in place. The frame of the press is of heavy 2-inch plate box type construction.

The third of these unusual machines is the boring mill shown in Fig. 4, which was produced in one-third of the time that would have been required by conventional methods. It weighs 15 per cent less than an equivalent conventional machine, even though the steel sections are much heavier than would be required to provide strength equal to that of cast iron. The cost of the machine with motors ready to run was $4485. This machine has a 96-inch table and a vertical clearance of 5 feet.

The three machines emphasize what amounts to a tradition with the president of the company, R. G. Le Tourneau, who says: "For the past seven years I have not used a casting or a rivet in my manufacturing process, although in the last year we have produced well over 25,000 tons of finished product."

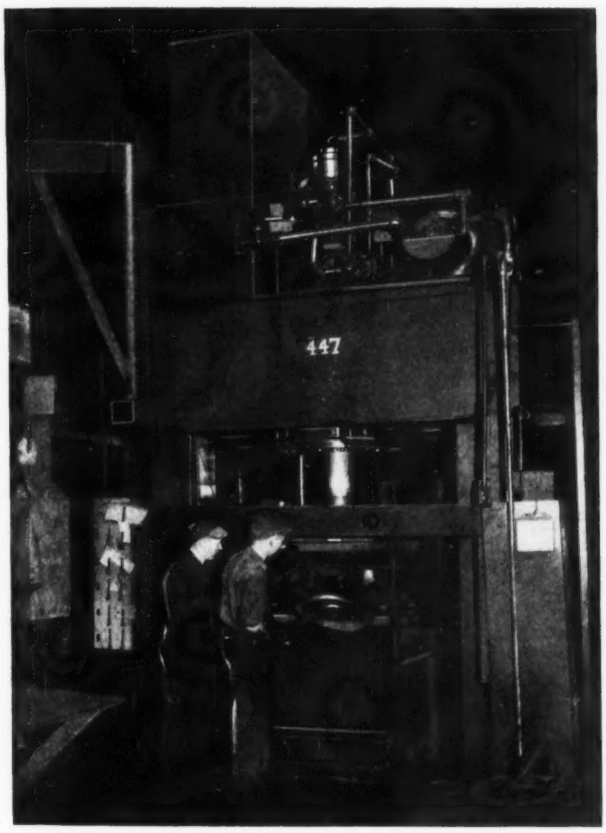


Fig. 3. A Hydraulic Press with Piston and Cylinder Made from Plates Rolled and Arc-welded

Fig. 4. Arc-welded 96-inch Boring Mill with a Clearance for Taking Work 5 Feet High

* * *

Meeting of Packaging Machinery Manufacturers

The annual meeting of the Packaging Machinery Manufacturers Institute, 342 Madison Ave., New York City, was held at the Westchester Country Club, Rye, N. Y., on November 16. The topics dealt with at the meeting covered patent problems, including patent liability, and a discussion of the Wages and Hours Bill, as well as of selling expenses and overhead charges.

Engineering News Flashes

The World Over

Noiseless Gears Made from Silk —A Japanese Development

According to the *World Machinery News*, published by the Machinery Division of the Bureau of Foreign and Domestic Commerce, a Japanese manufacturer has developed a synthetic material from a silk base which has proved to be especially suitable for gearing. The sericine content in silk is utilized in the manufacture of this gear material, no resin or similar substance being used. These gears are said to be oilproof, light in weight, nonwarping, and entirely noiseless in operation. They do not resist alkaline action, but are strongly acid-resistant, and can be used at high temperatures.

Low-Cost Resistance Welding Process Replaces Soldering Operations

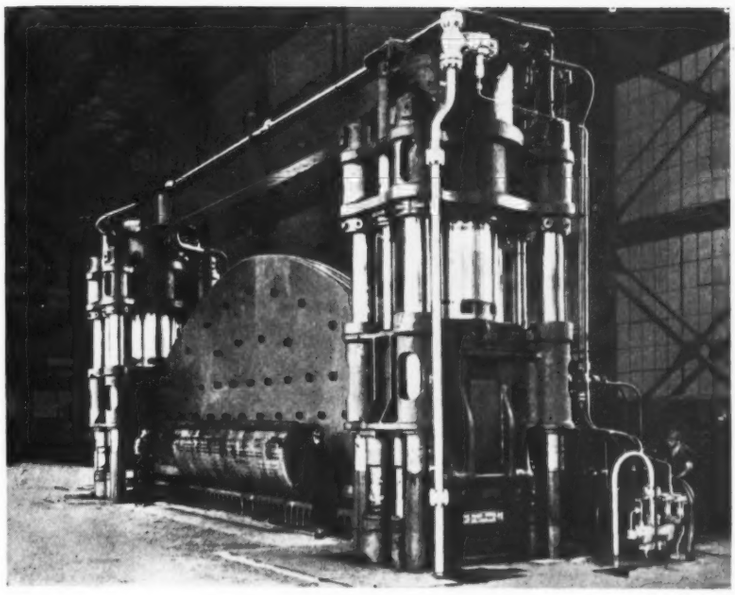
The General Electric Co., Schenectady, N. Y., has developed a low-cost resistance welding process of an electronic type to replace soldering operations in the manufacture of such devices as radio sets, watches, small meters, industrial control devices, railway signal equipment, and business machines. The process is suitable for welding solid or stranded wires to terminals, for welding small studs (0.010 inch to 0.050 inch in diameter) to flat surfaces, with little or no marking on the opposite side of the metal sheets, and for spot-welding thin sheets of various alloys, with little or no oxidation or discoloration.

New Electro-Galvanizing Process Introduced in the United States

The Marino electro-galvanizing process, which has been successfully used in England for about five years, is now being introduced into the United States and Canada (for license or sale) through George D. Hartley, 311 Main St., Worcester, Mass. The process incorporates electro-cleaning, pickling, and galvanizing in an entirely automatic procedure, and can be used for covering wires and metal parts with tin, lead, copper, brass, nickel, cadmium, or other metals and alloys. British experience indicates that the new process produces results 50 per cent faster than hot galvanizing, and that the cost is 40 per cent less than former costs. It is said to be especially suitable where rigid specifications are demanded, one mill in England turning out 50 tons of Marino galvanized high-tensile wire every week for the British government.

Since no heat is used in the process, it is pointed out that the zinc is not oxidized, no dross is formed, the zinc used in the process is completely utilized,

White Paint and Westinghouse Mercury-Mazda Lighting Units Provide the Equivalent of Daylight at All Times in the Christie Machine Works, San Francisco, Calif. The Accompanying Engraving was Made from an Unretouched Photograph Taken at Night, Using Only the Regular Shop Illumination



This Bending Press, Recently Completed by the Baldwin-Southwark Corporation, Philadelphia, Pa., for the Chattanooga, Tenn., Plant of the Combustion Engineering Co., is Believed to be the Largest ever Built. The Press is of 6000-ton Capacity and Handles Plates up to 40 Feet Long and 8 Inches Thick, Bending Them into Semicircular Shapes for High-pressure Steel Drums. The Bending Beams are 52 Feet Long, 15 Feet Deep, and 20 Inches Thick, Made from Plate Steel Construction. Total Weight of Machine is About 1000 Tons. Over-all Height is 40 Feet, of which 15 Feet Extend below the Floor

and there is no need of keeping the zinc in a molten condition over week-ends, or during other periods when the mill is closed.

An Airport Repair Shop that Can be Moved to a Disabled Plane

A so-called "mobile airport" has been developed by the Couse Laboratories, Inc., East Orange, N. J. This is a self-propelled workshop for aircraft and engine repair work, completely equipped with all the necessary machines and tools, field lighting equipment, and two-way radio communication apparatus. In this way, it is possible to bring the repair shop to a damaged air liner instead of moving the latter to its repair base. Dismantling and transporting large aircraft obviously involves great expense, and often causes damage in addition to that caused by the original mishap.

Three-Dimensional X-Ray Pictures for Inspecting Metals

X-rays have long been used in studying metals for interior defects; but because of the two-dimensional limitations of X-ray pictures, it has been difficult to determine the exact depth or distance of the flaws from the surface of the metal. Today, by the use of the X-ray stereoscope and stereometer, X-ray views can be made not only to show an internal flaw, but also to indicate its distance from the surface. Former mathematical methods made possible the determination of this depth to within, perhaps, 1/2 inch. The stereometer reduces this error to a maximum of 1/16 inch.

C. D. Moriarty of the Works Laboratory of the General Electric Co., Schenectady, N. Y., mentions the following applications of the new method: Determination of the over-all thickness of an inaccessible object or of internal parts of an object; study of the relation of defects to one another or to the surface of the object; determination of the amount of dip or rise in a "pipe" in metal products. The instrument is easily adjusted and applied, and no calculations are required to determine the dimensions indicated by the instrument.

A Gearless Automobile Featured in England

A gearless and clutchless car was recently demonstrated at a meeting of the British Association. In this car, power is transmitted through a turbine driven from a centrifugal pump. The drive has been developed by Piero Salerni, and is said to have proved to be unusually smooth and satisfactory. A car driven with this apparatus has been run over 65,000 miles with few signs of wear. It is said that even the tires show less wear because the transmission relieves the car of shock loads. It is believed that the cost of building the new equipment should compare favorably with that of present transmission systems.

Airplanes Ordered by the Thousands in Great Britain

What is believed to be the largest single aircraft order ever entered at one time has been placed by the British Government. It calls for one thousand high-speed "Spitfire Fighters," to be built by Lord Nuffield's new aircraft factory at Birmingham, England. This factory, now under construction, will when completed employ between 12,000 and 15,000 men. It is stated that Lord Nuffield has invested approximately $15,000,000 in the venture. This new factory, it is said, will be the largest aircraft plant in England, if not in the world.

EDITORIAL COMMENT

Everyone familiar with industrial labor history knows that much of the strife between employer and employe has been due to the misinformation that has been given to the wage-earner by the political and labor agitator. Unfortunately, industrial management has done very little to combat this flood of misinformation. Stories have been told of enormous profits made by industry at the expense of the wage-earner. Industrial management has been rather slow to counteract this misinformation by presenting the true facts.

It is, therefore, of especial interest to note that the Westinghouse Electric & Mfg. Co. has published a statement giving a complete financial summary of the operations of the company for the nine years from 1929 to 1937. This statement gives the actual figures in dollars and cents; but some of the facts may be more easily grasped if reduced to a percentage. We therefore give the expenditures of the company for every $100 worth of products sold by it.

Management Gives Facts to Combat Misinformation

For every $100 taken in by the Westinghouse company, $38.90 was paid out again in buying materials, supplies, fuel, etc.; $4.60 was set aside for replacing buildings and machinery; and $3.40 was paid to the government tax collectors.

This left $53.10 out of which to pay wages and salaries, to lay up a reserve for future needs, and for a return to the stockholders who provided the money with which the company's buildings and its machinery and equipment were acquired. Of the $53.10 that was left for these purposes, $46.70 was paid out in wages and salaries to the company's employes, in addition to which $1.20 was paid for employes' group insurance and to the employes' annuity fund. It will be noted that by far the larger share of the money available for wages to employes and dividends to stockholders was paid out in wages. As a matter of fact, only $5.20 remained as net earnings of the $100 actually taken in for the product sold. These net earnings were used partly for dividends to stockholders and partly to create a reserve fund to meet losses in depression years.

All the Money Did Not Go to the Stockholders

It is also worthy of note that the Westinghouse company was more fortunate in respect to its net earnings than the average manufacturing company in the United States during the period from 1929 to 1935. Figures published by the United States Treasury Department for all manufacturing companies in the United States indicate that out of every $100 of income of these companies, only $2.23 remained as net earnings after wages, taxes, cost of materials, etc., had been paid.

It is information of this kind that employers should distribute among their employes. The fact that the figures in the preceding paragraph are based upon compilations by the United States Treasury Department gives them added authority. It is time that it be generally understood that, compared with wages paid, the net earnings of the average manufacturing company are small; and that increased wages cannot possibly be obtained by taking them out of present company earnings, since there is very little there.

Increased wages and an improved standard of living can be had only by producing more of the comforts and necessities of life at lower costs, so that these comforts and necessities may be enjoyed by a constantly larger number of people. Lower costs, again, can be attained only through an increased use of machinery and mechanical facilities and through the employment of these facilities for a reasonable number of working hours per week. There can be more to share only when there is more produced.

Increased Wages Must Come from Productive Work

The people who glibly assert that industry should provide more jobs indicate by that very statement how profound is their ignorance of the underlying facts of business and industry. But these jobs do not just happen. Jobs can come only through sales, and there can be sales only if there are customers. The customers are the general public, including the men and women who demand that industry provide more jobs. It is the buying public that must provide the jobs. Unless somebody buys the product of the manufacturer, he cannot provide jobs.

Who is it that Really Provides More Jobs?

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Double-Action Reversing Ratchet Movement

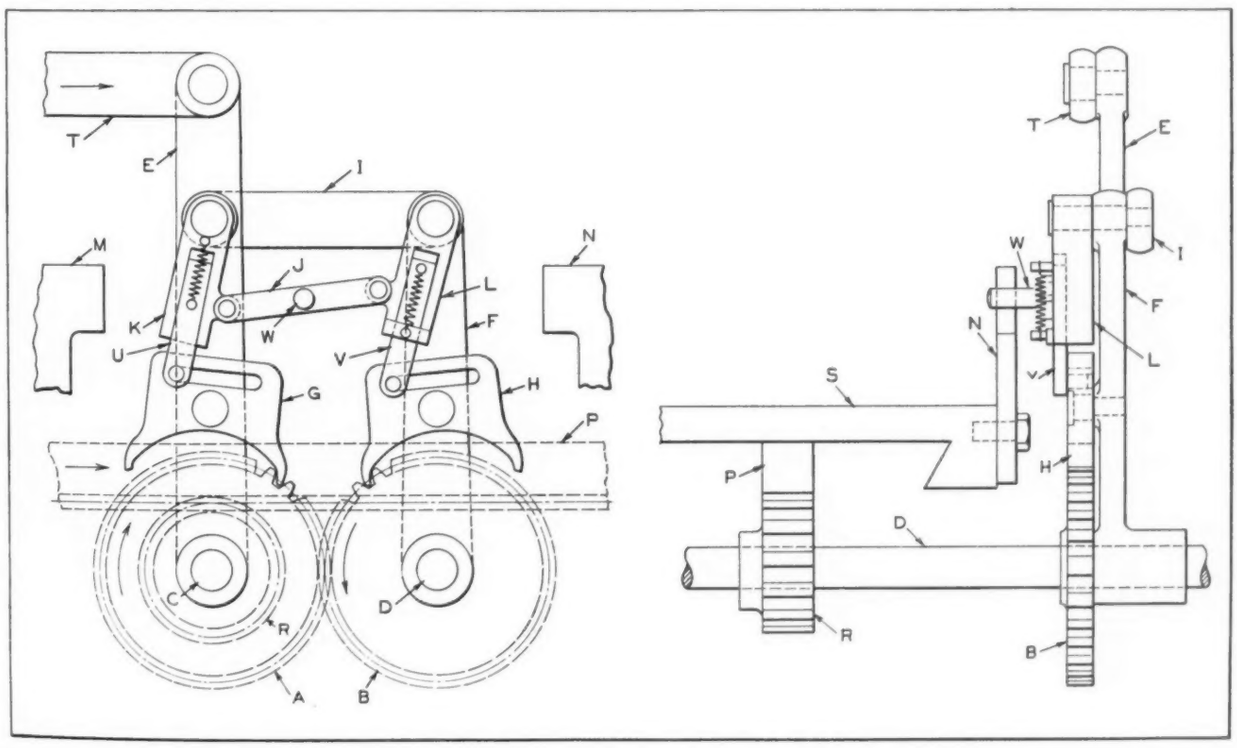
By L. KASPER

A machine used for polishing a wire product has a traveling table which is given an intermittent motion by means of a rack and pinion actuated by an oscillating lever through a ratchet and pawl. In the original design, the pawl actuated the ratchet during one-half of the oscillating cycle of the lever, the pawl riding over the ratchet teeth on the return stroke in the conventional manner.

In the improved design, shown in the accompanying illustration, two pawls *G* and *H* are employed to rotate the gear *A* in a clockwise direction on both the forward and reverse strokes of the oscillating lever *E*. Referring to the illustration, rod *T* is given a reciprocating motion by means of a crank, thus transmitting an oscillating motion to lever *E*, which is free on shaft *C*. Gears *A* and *R* are keyed to shaft *C*, gear *R* meshing with the rack *P*, which is carried on the work-table *S*.

Referring to the view at the left, lever *E* transmits motion to lever *F* through the link *I*. Lever *F* and gear *B* are free to rotate on shaft *D* and gear *B* meshes with gear *A* on shaft *C*. Levers *E* and *F* carry the pawls *G* and *H*, respectively. Pawls *G* and *H* are slotted to receive pins on the ends of rods *U* and *V*, which slide in dovetailed grooves in levers *K* and *L*. Rod *U* is drawn upward by a spring, while rod *V* is drawn downward by a similar spring. Levers *K* and *L* are connected by the link *J*, which carries pin *W* at its center. Any horizontal movement of pin *W* causes levers *K* and *L* to move in unison. Stops *M* and *N* in work-table *S* serve to trip the pawls at both ends of the work-table travel.

Referring to the view at the left, the rod *T*, moving in the direction indicated by the arrow, transmits motion through lever *E* and pawl *G* to gear *A*, giving the latter a partial rotation in the direction indicated by the arrow. As both gears *A* and *R* are keyed to shaft *C*, the motion of gear *A* is transmitted through gear *R* to the rack *P* in the direction indicated. Gear *A* transmits its motion to



Reversing Ratchet Mechanism Designed to Rotate Ratchet Wheel on Both Forward and Return Movements of Pawl Lever

gear *B* in the reverse direction, gear *B* serving no useful purpose at this time, merely turning under the pawl *H*.

As rod *T* reaches the end of its travel and reverses its direction, levers *E* and *F* also reverse their direction of travel. At this point, the reverse motion of lever *F* is transmitted to gear *B* through pawl *H*, the motion being continued through gears *A* and *R* to the rack *P*. In this manner, both the forward and return strokes of rod *T* are utilized to transmit motion to the rack *P* in the same direction.

As the stops *M* and *N* are attached to work-table *S*, they move with the rack *P*. In the position shown in the view to the left, each movement of rack *P* brings the stop *M* closer to pin *W*. As stop *M* strikes pin *W*, the levers *K* and *L* are made to swing to the right, which, in turn, causes the outer ends of pawls *G* and *H* to engage the gears *A* and *B*. As this causes gears *A* and *B* to rotate in the reverse direction, the movement of rack *P* is reversed. This motion continues until stop *N* strikes pin *W*, when the direction of movement is again reversed.

Double Reciprocating Mechanism with Displaced Operating Positions

By JOSEPH WAITKUS

The mechanism shown in the accompanying illustration was developed to produce two distinct reciprocating movements of the feeding rod *S*. The limits of each of the reciprocations are identical, the difference being in the relative positions of the rod when the reciprocations take place. The action is best described by referring to the two diagrams which show the movements in the two reciprocating positions. The diagram below rod *S* designated Position 1 represents one reciprocating movement starting at a point marked 1, extending to 2, and finally returning to 3. When the mechanism is displaced, so that the upper end of rocker *H* occupies the position indicated by dotted lines in Position 2, the reciprocation starts at 4, extends to 5, and comes to rest at 6. This sequence of movements may be likened to the movements of a crank whose entire structure can be displaced or moved from Position 1 to Position 2, thereby giving the same reciprocating movement at two distinct points or positions separated by a definite distance. Provision is also made for time adjustment between the reciprocations.

The mechanism is actuated by gear *A*, which drives idlers *B*, the latter, in turn, driving the gears *C* on the studs *D*, in the main plate *E* of the machine. Gears *C* are provided with gear segments *F* and *G*. A slot in the gear segments permits adjusting their positions on gears *C* to produce a definite relation between the positions of the two segments in their continuous rotation with the gears.

The rocker arm *H* is pivoted on the stud *J* and is free to oscillate between gears *C*. Two mutilated gears *K* and *L* are fastened to the shaft *M* by pin *N*. In order to retain shaft *M* in place on the rocker arm *H*, the link or crank-arm *O* is fastened to the shaft *M* by pin *P*. Crank *O* is provided with the guide pin *Q* which fits into the concentric slot *R* in the rocker-arm head. Crank *O* is connected to the reciprocating rod *S* through the connecting-rod *T*.

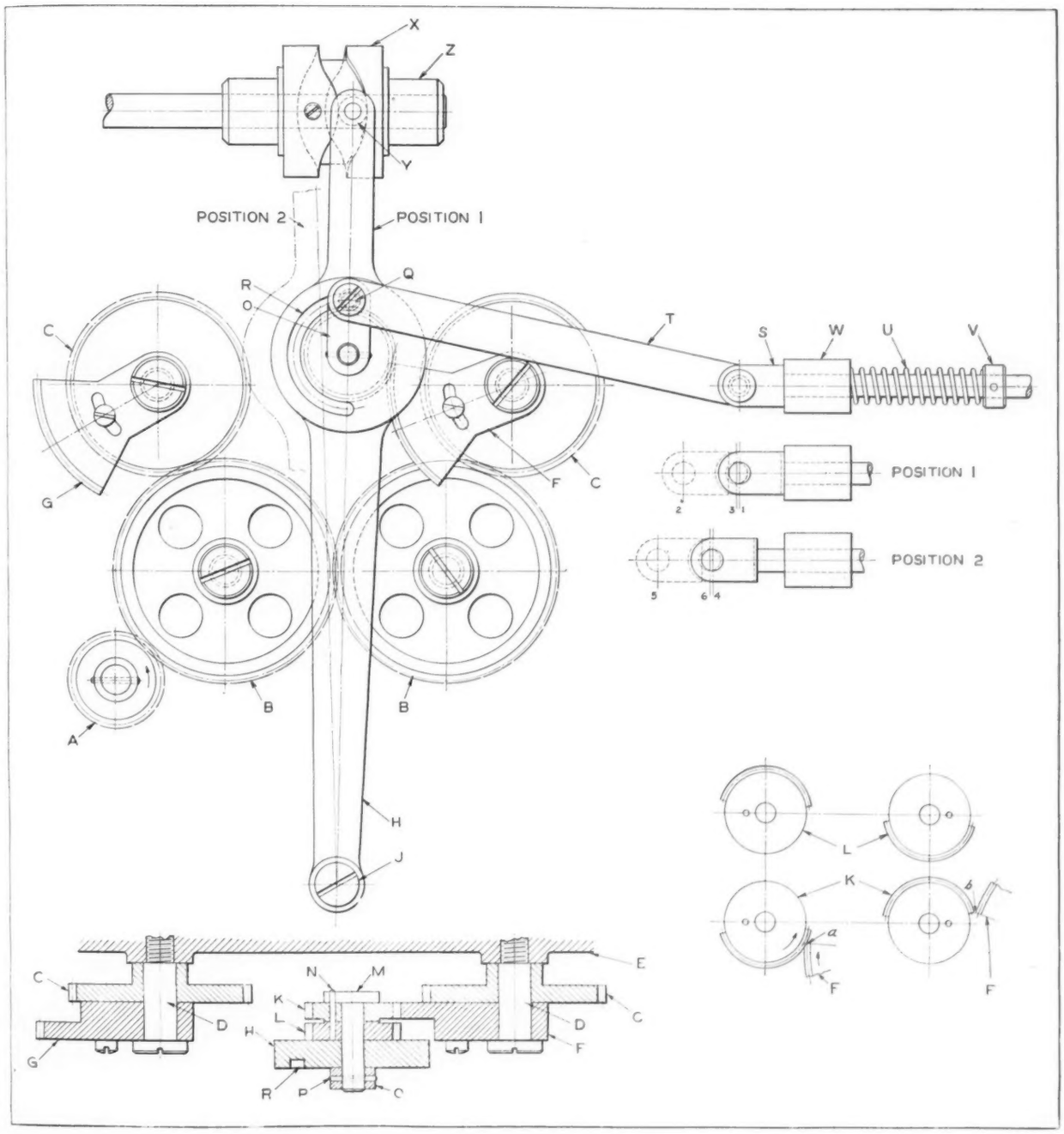
The spring *U* furnishes the necessary tension between a collar *V*, fastened to rod *S*, and the bearing block *W*, which is a part of the main plate *E*. The cam *X* actuates rocker arm *H* between the gears *C*. A roller *Y* at the end of the rocker arm fits in the slot of the cam and produces a simple oscillating motion of the rocker arm. The bearing blocks *Z* support cam *X*.

The functioning of the mechanism is controlled by cam *X*. The cam is so designed that one revolution is necessary for a complete cycle of the reciprocating member *S*. One cycle consists of starting in Position 1 and returning finally to the same position. The cam can be given any irregular shape or form necessary to give any time cycle required of the reciprocating mechanism.

The mutilated gears *K* and *L* are alternately brought into contact with the gear segments *F* and *G*, which are displaced in such a manner as to make contact with their respective mutilated gears. The diagram in the lower right-hand corner of the illustration shows the form and relative positions of the mutilated gears at two moments in Position 1. First, we have the gear segment *F* in contact with gear *K* at *a* ready to rotate the unit. The position of gear *L* should be noted at this time. The next view shows the gear segment *F* after it has completed its driving movement of gear *K* and is passing away from it at *b*. The changed position of gear *L* at this point should be noted. Gear *L* is now in such a position that when the rocker arm *H* is moved to Position 2, gear segment *G* can be engaged with it and made to produce a reverse rotation of gear *L*, returning link *O* to the upper part of the rocker-arm head and thus completing the reciprocation for Position 2.

It will be noted that points 1 and 3, as well as points 4 and 6, shown in the two position diagrams do not coincide. This is due to the fact that the slot *R*, subtending an angle of 180 degrees, combines with the angularity of rocker *H* to produce a slight difference in positions. However, this difference is necessary in the process to which the mechanism is applied. It is interesting to note that by slightly extending the slot at each end, the difference can be eliminated, and the points 1 and 3, as well as 4 and 6, can be made to coincide.

An interesting feature of the mechanism is that it provides a wide range for the timing of the interval between reciprocations. The timing is controlled by cam *X*, which is so interconnected with gears *C* that their positions are in a definite relation to the position of the cam *X* at all times. With the cam rotating intermittently, so that there is a



Mechanism for Producing Reciprocating Movements of Rod S in Two Different Positions

sufficient pause in each position of rocker arm *H* to give the segment gear time to complete its function, there will be a definite time interval between reciprocations, dependent upon the relative positions of the two gear segments on their respective gears *C*. The interval can be varied by alternating the gear segments and bringing them closer together or spacing them farther apart.

* * *

About 2,000,000 tons of steel rail, enough to build a single-track road 10,000 miles long, are bought each year by the railroads of the United States.

Progress in the Plastics and Vulcanized Fiber Industries

The great development that has taken place in the plastics and vulcanized fiber industries is indicated by the statistics published by the Bureau of the Census, Washington, D. C., covering production in these industries in 1937. The average number of wage-earners employed was less than 7000 in 1933, while it was upward of 17,000 in 1937. The value of the product rose from $25,700,000 to $77,700,000, and the number of establishments making products from plastics and vulcanized fiber increased from 101 in 1933 to 160 in 1937.

Tungsten Carbide Greatly Increases Gage Life

By GEORGE EGLINTON, Vice-President
Lincoln Park Tool & Gage Co.
Lincoln Park, Mich.

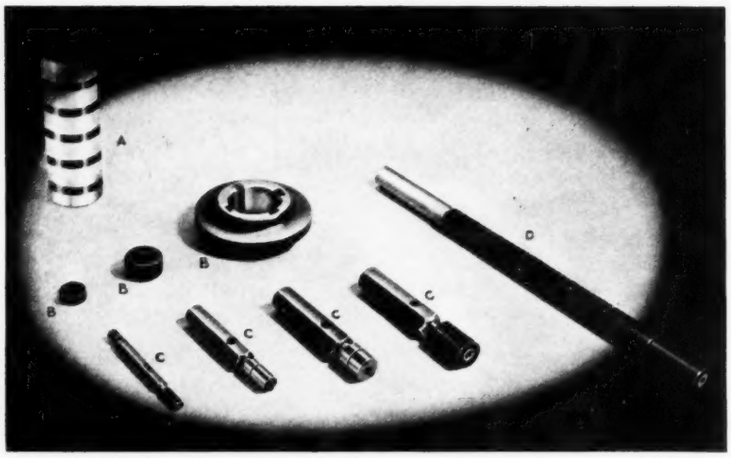


Fig. 1. Ring and Plug Gages Made with Inserts, Rings, or Bushings of Tungsten Carbide to Obtain Long Life

DEVELOPMENTS in the art of grinding tungsten carbide since the advent of this material for metal cutting have not only greatly reduced tool sharpening problems, but have also facilitated the use of tungsten carbide in the construction of gages. For this usage, obviously, it must be possible to grind tungsten carbide to specified dimensions within close tolerances and without too great a labor cost. Diamond grinding wheels and knowledge of the correct procedure to be followed have made this possible.

A variety of gages with inserts and solid pieces of Carboloy have been made by the Lincoln Park Tool & Gage Co., typical examples being shown in the accompanying illustrations. At *A* in Fig. 1, for example, is shown a special plug gage consisting of five rings of Carboloy separated by tool-steel spacers. Each successive tungsten-carbide ring is 0.0002 inch larger in diameter than the preceding one. This gage is used for grading ball- and roller-bearing cones. As the tungsten-carbide rings wear, they can be reground to the next lower size, and thus used over and over again until they become smaller in diameter than the smallest ring.

The gage rings and spacers are assembled on a mandrel for use in a hydraulically operated machine. The nominal size of the gage shown is 2 1/8 inches. The initial cost of this type of gage is approximately six times that of the chromium-plated tool-steel gage previously used, but the greatly increased life more than justifies the investment. The higher cost of tungsten-carbide gages is due more to the labor charges involved in their manufacture than to the cost of the material, in spite of a rather general misconception.

At *B* in Fig. 1 are shown three ring gages, of as many distinct designs. The small gage at the left is made of solid Carboloy with a hole 1/4 inch in nominal diameter. The outside diameter is 3/4 inch and the length 3/8 inch. The next gage is made with an inner ring of solid tungsten carbide and an outer band of tool steel. The nominal diameter of the hole in this gage is 9/16 inch and it must be accurate as to size within 0.00002 inch. Solid Carboloy was used in this instance, because with inserts of tungsten carbide, the difference in the expansion between the two metals would make it difficult to retain the high degree of accuracy required. Larger ring gages are generally made with inserts of tungsten carbide, as in the case of the right-hand gage *B*.

Four "Go" and "No Go" plug gages are shown at *C*. The one at the extreme left is made with ends of solid Carboloy. The next two gages have inserts ground in two steps, while the gage at the right in this group is made with a sleeve or bushing of solid Carboloy mounted on a tool-steel shank.

Gage *D* consists of six solid Carboloy sleeves mounted on a long mandrel for

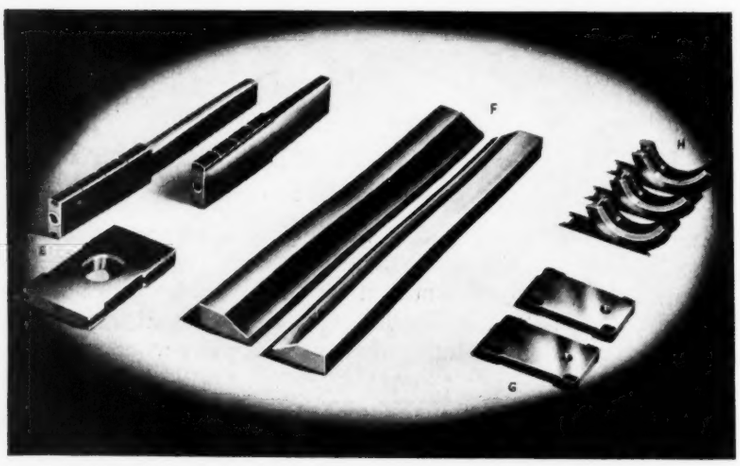


Fig. 2. Plug and Width Gages, Straightedges, and Steadyrests with Inserts of Tungsten Carbide

grading automobile connecting-rods with respect to the size of their wrist-pin holes. Each Carboloy sleeve is 1 1/2 inches long. These sleeves are butted against each other, an under-cut being ground in the end of each sleeve that seats against a shoulder of the preceding sleeve. Gages of this type have been found to last up to 200 times as long as the conventional tool-steel gages previously used, the initial cost being only about ten times as much. As the Carboloy sleeves become worn, they can be reground to the next smaller size and moved forward on the mandrel.

Flat gages used for determining out-of-roundness in the cylinder bores of refrigerator compressors are shown at *E*, Fig. 2, together with a "Go" and "No Go" gage of flat design. The out-of-round gages are made with four steps that increase in diameter increments of 0.0001 inch. It will be observed that one gage is made with tungsten-carbide strips extending the full width, while on the other the tungsten-carbide strips are inserted. The full-width type gage lasts somewhat longer than the other one.

A pair of straightedges, 15 inches long, faced with strips of Carboloy, are shown at *F*. These straightedges are used in a fixture for grading the rollers of roller bearings, and the Carboloy edges must be straight for the entire length of the piece within 0.00005 inch. The straightedges are checked by placing them in contact with each other on the glass top of a cabinet having an ordinary electric light inside. It has been proved that light will pass through straightedges having an error of 0.00005 inch. The edges can be relapped an indefinite number of times. The Carboloy inserts of each straightedge consist of fifteen pieces 1 inch long and 1/8 by 5/64 inch in cross-section.

"Go" and "No Go" gages of the styles shown at *G* have been made for checking the length of the crankpins on automobile crankshafts. These gages cost approximately five times the price of tool-steel gages, but one set used in a high-production job lasted an entire year, whereas the tool-steel gages previously used had to be replaced weekly.

At *H* are shown steadyrest shoes for supporting automobile camshafts on the bearings while the cams are being ground. When shoes of tool steel were used for this purpose, they had to be adjusted several times a day, and were worn out at the end of two or three weeks. Since making the shoes with narrow semicircular inserts of Carboloy, they need be adjusted only once a month and they last indefinitely. The Carboloy shoes cost only about six times the price of the tool-steel shoes.

The Progress of Industrial Arbitration

THE American Arbitration Association has been active for over thirteen years. Its contribution in the field of commercial arbitration has grown to the point where such arbitration is now regular practice of a great number of business groups and trade associations. New York was the first state to adopt a law making an agreement to arbitrate irrevocable and enforceable. Many other states have since followed the New York pattern, until it is now possible to arbitrate under the rules of the American Arbitration Association in forty-six of the forty-eight states.

The newest activity of the Association comes under the heading of industrial arbitration. Such arbitration relates exclusively to the settling of differences between employer and employe. The Association developed what was known as the Voluntary Industrial Arbitration Tribunal in October, 1937. During the first year of its operation this new tribunal handled more than 100 cases, each of which was settled to the satisfaction of the parties involved. In every instance, the arbitration awards have been lived up to voluntarily. The questions that have been handled by the tribunal have ranged from the discharge of an employe to problems involving the wishes of thousands of workers. Small problems that have so often been the cause of strikes in the past have been satisfactorily settled by the tribunal. Many of the cases have covered seniority rights, union recognition, etc.

The Association is voluntary and non-political. Its method provides for the selection of arbitrators from a national panel of more than 7000 men, chosen for their integrity and high standing. These men serve without fee as a contribution to the public good.

Among the advantages accruing from the use of industrial arbitration the following may be mentioned:

1. Voluntary industrial arbitration settles disputes with greater speed.
2. Where it is known that disputes will be settled by arbitration, work is not stopped—goods continue to move—and money is saved for both management and labor.
3. It is economical; it saves the usual high costs of court and strike procedures, replacing them with a nominal expense for each of the parties involved.
4. It maintains good will between management and labor and contributes as a whole to the cause of industrial peace.
5. It is a method that minimizes the future need for labor legislation, colored as it often is by political considerations, both in its original conception and in its subsequent administration.
6. It is a technique that the experience of England, Sweden, and other countries indicates has worthwhile advantages, from both an individual and a national point of view.
7. It is in a sense the answer of private business to the question of how industrial disputes may best be settled.

Die Design and Construction

A Treatise on the Principles Embodied in the Design of Different Types of Sheet-Metal Blanking, Forming, and Drawing Dies—Eighth of a Series of Articles

By CHARLES R. CORY*

THE seventh article in this series, published in September MACHINERY, page 33, dealt with the progressive type of blanking and piercing dies. The present article will continue the description of dies of this type.

A great variety of operations can be combined with the blanking operation in a progressive die. The most common type of die performs blanking and piercing operations; but embossing, flanging, and drawing can also be combined with the blanking and piercing. Often an automatic feed can be used to feed roll stock. The blanking stage is usually the last one, since it is better to have the blank remain a part of the stock strip until the last stage, in order to make the feeding easier. Part of the blanking operation, however, can be performed as a notching operation, so that the final blanking only separates the part from the stock strip at points where blank and strip are still held together.

*Die Engineer, Fisher Body Division, General Motors Corporation, Detroit, Mich.

In the die shown in Fig. 8, tabs are sheared and formed from the flat stock in the first stage and the part is blanked in the second stage. In the first stage, a spring stripper holds the stock strip down on the top face of the die. On the down stroke, while the stock strip is held by the spring stripper, the punch for shearing and forming the tab operates. On the up stroke, the spring stripper holds the stock strip against the die until the punch has left the stock strip.

The bottom face of the punch for shearing and forming the tab is an inclined surface, so that the end of the tab is sheared before it is formed. The shearing occurs progressively, starting at the tip of the tab and continuing toward the base. There is a tendency for the metal to curl as it is sheared progressively, and hence, the punch must be long enough to "wipe" past the entire length of the tab, if the tab is to be formed vertically. If the tab is to be formed to an angle, the punch must "spank" the entire surface of the tab at the bottom of the punch stroke.

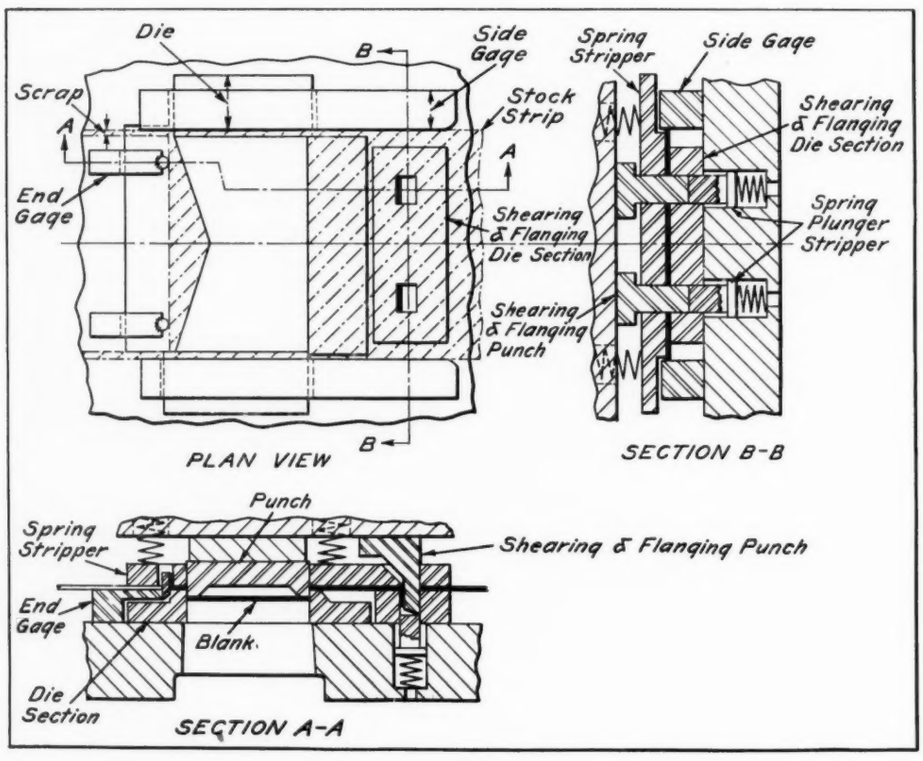


Fig. 8. Die for Shearing, Forming Tabs, and Blanking

If the tab has parallel sides, it will be a press fit in the die hole and will have to be stripped out of the die for the full length of the tab; to accomplish this, a spring plunger stripper is added in the tab hole of the die. If the sides of the tab are not parallel, the tab being narrower at the end, it will stick in the die at the base only. In that case, the arrangement shown in Fig. 9 may be used, omitting the use of a spring plunger stripper.

Another method of preventing the tab from sticking in the die is to cut a clearance notch in the die sidewise, in line with the final position of the tab, as shown in Fig. 10. The notch allows the formed tab to clear the die. The last part of the shearing, close to

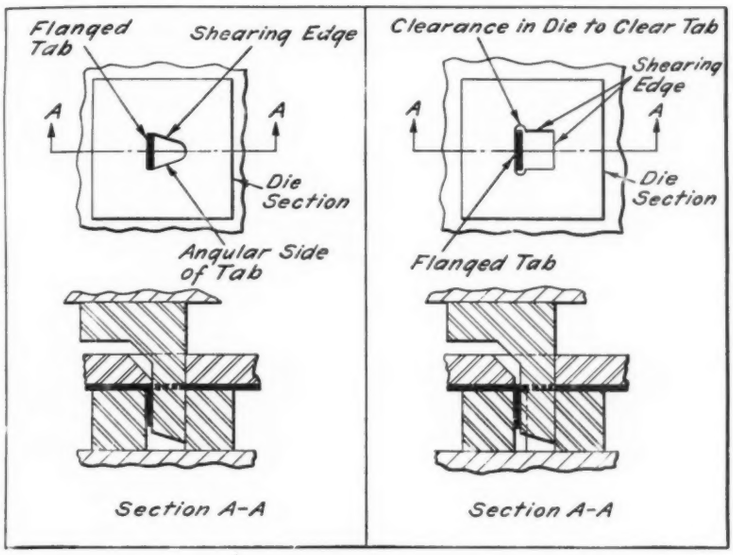


Fig. 9. (Left) Arrangement for Stripping when the Tab is Narrower at the End, so that it Sticks in the Die at the Base Only
Fig. 10. (Right) Die with Clearance Notch for Freeing the Tab

the base of the tab, is more a tearing than a shearing process. There is no part of the die for the punch to cut against at that point. The operator must raise the stock strip until the tab is above the die before feeding it to the next operating position.

The addition of a tab shearing and forming operation often makes a right- and left-hand die necessary if right- and left-hand parts are required. This is due to the fact that the blank with its formed tabs cannot be turned upside down to make a part of the opposite "hand."

The punch may be of a commercial type, for easy replacement, if less than 1 inch in size. An advantage of using commercial punches is that enough punch-retainers may be provided for punches for shearing and forming the tabs in both right- and left-hand parts, since the punches can be easily changed from one set of retainers to the other.

Progressive Embossing, Piercing, and Blanking Die

A three-stage die may be used to form an embossed part in the first stage, pierce it in the second stage, and blank it in the third stage, as indicated in Fig. 12. A spring stripper rather than a solid stripper should be used to hold the stock strip during the embossing, as it prevents wrinkles from forming in the metal around the embossed part. The spring stripper should bottom on the punch-shoe at the end of the stroke, so that the panel surface will be "spanked" on its entire area. The piercing and blanking stages resemble the conventional progressive die construction. Two preliminary gages are required.

This type of die could not be used for a part with a deep depression, because the piercing punches of such a die would be likely to be broken by the shifting or moving of the metal of the stock strip, due to the fact that more square inches of metal are necessary for the depression than for a flat blank. In some cases, the tendency of the stock to wrinkle, because of the shifting of the metal into the depression, can be reduced by adding a notching stage before the embossing stage. The metal can then flow more freely.

A part such as described can also be produced in a two-stage die, piercing it in the first stage and blanking and forming it in the second one, as indicated in the upper view of Fig. 11. The blank is gripped in the second stage by a pressure pad inside the hole of the die. As the blanking punch continues its downward travel, the pressure pad is forced down. During the downward travel of the pressure pad, the embossing punch, mounted solidly on the die-shoe, draws the metal of the blank to the shape required. On the up stroke of the press, the pressure pad acts as a stripper, forcing the finished part out of the die.

The finished part has a smaller area than the flat blank from which it is formed, so it does not stick in the hole of the stock strip and can be blown off the die with a jet of air. The edge of the finished part may not be correct, since the blank may not be drawn into the embossed shape symmetrically each time. This difficulty can be overcome by adding a pilot gage-pin in the blanking punch which will enter the pierced hole of the blank and prevent the blank from shifting.

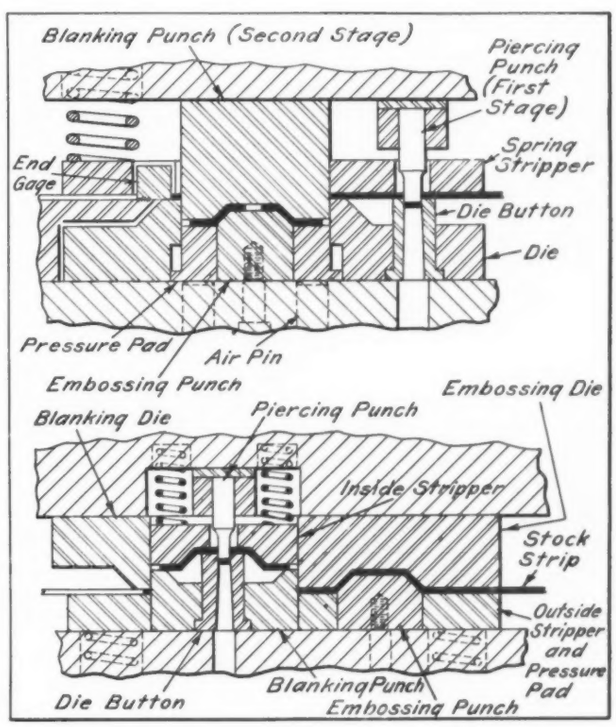


Fig. 11. Two Two-stage Dies, Either of which can be Used to Produce the Part Made in the Three-stage Die Shown in Fig. 12

The same type of part can be produced with another kind of two-stage die, embossing in the first stage and piercing and blanking in the second one, as indicated in the lower view of Fig. 11. The stock strip is supported on a pressure pad, which grips it against the embossing die. As the pressure pad travels downward, the embossing punch draws the embossed shape of the part in the first stage, and the blanking punch blanks the finished part from the stock strip in the second stage. The second stage is in reality a compound blanking and piercing operation, the hole being pierced by the piercing punch when the blank travels up in the blanking die opening. The inside stripper may be operated by some positive knockout device on the press at the top of the stroke.

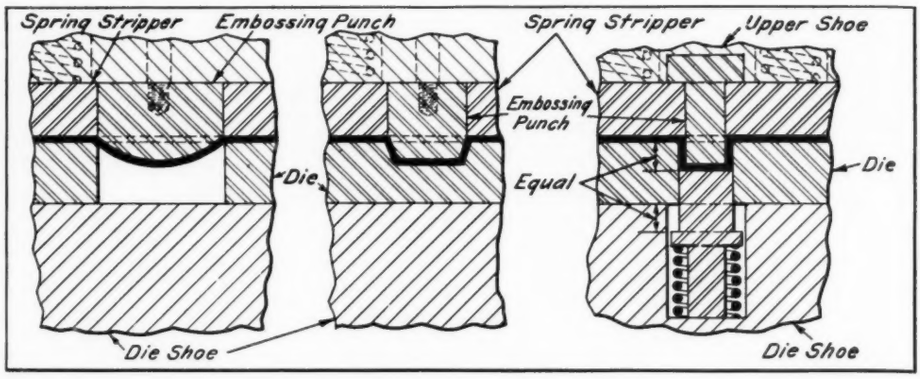


Fig. 13. Die Designs for Different Kinds of Embossed Parts

A disadvantage of both of these types of two-stage dies is that they are probably slower than a three-stage die, in which the blanking stage is of the drop-through type. An advantage is that the blank is entirely disconnected from the stock strip before the second stage, so that there is no pull on the piercing punch resulting from the shifting metal.

If the depression is of such a shape that the metal, while being formed from the flat surface, will wrap around or hug the embossing punch, it is not necessary to press the metal forming the depression against a solid die, or, as it is called, to "spank" it with the die. In that case, the die may have a hole under the punch the size of the outside shape of the depression, as indicated to the left in Fig. 13. If there is a flat spot in the depression, however, with a sharp corner, the metal will not hug the punch unless the die fits the punch so as to "spank" the panel to the correct shape, as indicated in the center of Fig. 13.

If the embossed part has vertical side walls, as shown to the right in Fig. 13, the die should have a spring plunger which will strip the stock from the hole in the die. Even if not necessary for stripping, it is advisable to use spring plungers to lift the stock out of the hole in the die. The operator then need not lift the stock prior to feeding it to the next operating position.

Piercing, Countersinking, and Blanking Die

There are two types of countersinking. In *flat* countersinking, the blank remains flat, but the hole through the blank is swaged to a tapered or countersunk shape. In *form* countersinking, the blank around the hole is formed to a conical shape projecting beyond the flat surface. An example of flat countersinking is shown in Fig. 14, and an example of form countersinking in Fig. 15.

For flat countersinking, the punch is made so that a hole equal in diameter to the small diameter of the desired countersink is pierced. About 1/4 inch above the piercing point of the punch there is a tapered shoulder. At the bottom of the stroke, this punch shoulder squeezes the metal sidewise to produce the countersink. It is very difficult to swage the metal to a countersink shape, and there is usually a high rate of punch breakage. Flat countersinking is, therefore, usually avoided as a press operation. If countersinking is required, it is preferable to do this work in a drilling machine after piercing and blanking the metal parts.

For form countersinking, the punch is of the same type of construction as for flat countersinking, except that the point diameter is smaller than

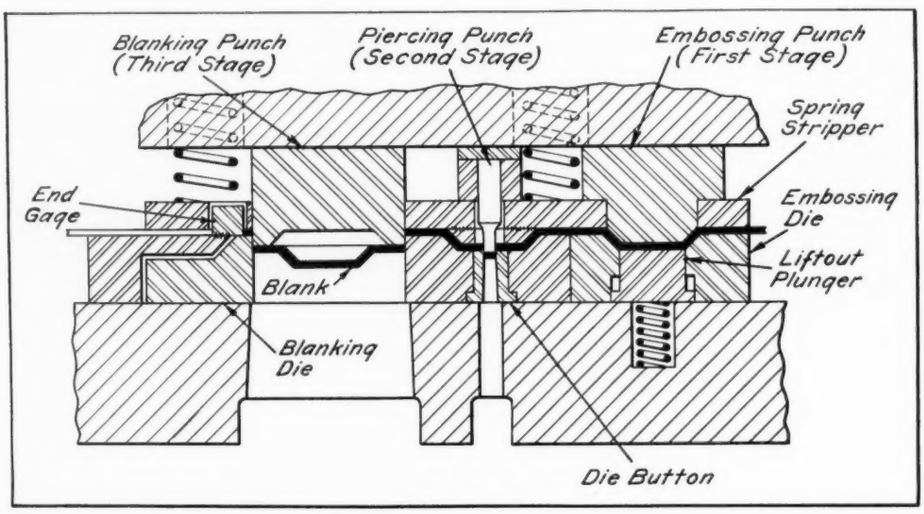


Fig. 12. A Three-stage Embossing, Piercing, and Blanking Die

the small diameter of the desired countersink. The piercing point of the punch forces the metal down into the countersink shape of the die. Before the metal touches the countersink shape of the die, the punch point shears through or pierces the metal. The countersink form of the punch "spanks" the metal down to the countersink shape at the end of the stroke. During the last phase of the process, the hole that has already been pierced in the part is enlarged, so that the hole in the finished part is larger than the point of the punch. The proper size of punch point must be determined by trial.

The die does not do any real cutting in the case of the piercing operation just referred to. The hole in the die is considerably larger than it would be with ordinary die clearance for the punch. The pierced slug, therefore, is much smaller than the hole in the die. The spring-operated upper stripper should bottom on the punch-shoe at the end of the stroke; otherwise, the metal will bulge up around the countersunk hole.

If right- and left-hand parts are required, right- and left-hand dies are necessary, since the blank is no longer flat and cannot be turned upside down to make a part of the opposite "hand." There is an exception in the case of blanks in which the position of the countersunk holes may differ for right- and left-hand parts, but which otherwise are symmetrical. Then one die can be made to serve for both the right- and left-hand parts by simply changing the location of the countersinking punches and duplicating the die holes for the right- and left-hand parts.

A progressive type of die can be used for combinations of operations that could not be performed in a compound die. The number of stages that may be used is limited only by the practicability of doing the work in that manner and the economy of performing the operations in a multi-stage die. Obviously, the larger the number of stages, the greater complexity there is in the die design. The speed of operation in a progressive type die, however, may justify considerable die expense. Automatic feeding with roll stock can also be used on a progressive die, since the blank drops through the die and requires no attention from the operator.

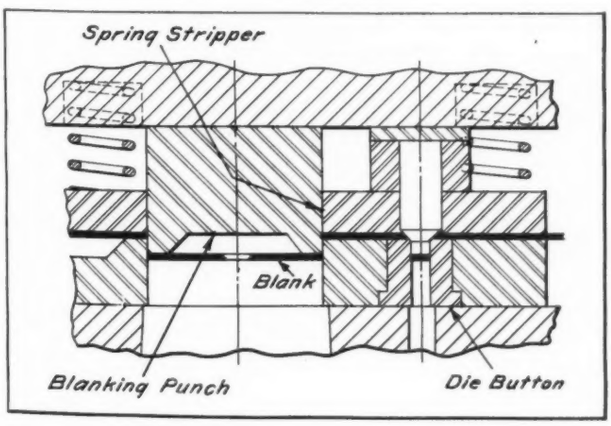


Fig. 14. An Example of Flat Countersinking

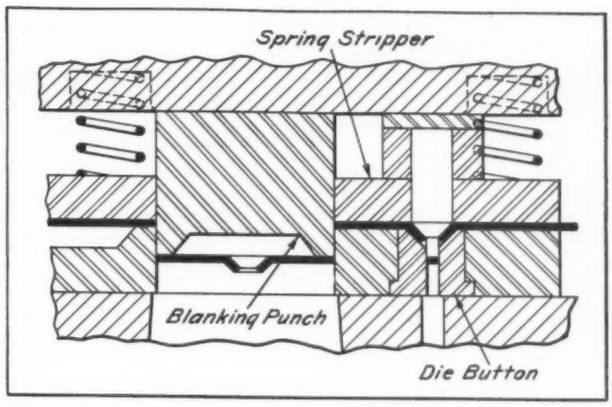


Fig. 15. An Example of Form Countersinking

How Improved Machinery and Advertising Create Employment

In emphasizing how improved machinery and advertising in combination have been the very cornerstones of American industry, increasing industrial employment and improving living standards, the Bureau of Research and Education of the Advertising Federation of America, points out that, in about 1870, the amount of mechanical power used to operate machines was only 1 1/10 horsepower for every wage-earner. Sixty years later, nearly 5 horsepower per wage-earner was employed.

As a result, the amount of work turned out by each man rose so rapidly during this period that the value of the product per man increased fivefold. In the meantime, employment was greatly increased, so that while the population increased only about three times, there were nearly four times the number of people gainfully employed; and as industry substituted machines for hand labor, the annual earnings per worker increased nearly four and one-half times.

"When we think of this tremendous progress, it is well to remember that the greatly enlarged output of industry does not automatically find a market," says the Advertising Federation of America. "One of the most important factors in distributing the ever increasing volume of goods is the use of advertising, without which this mass distribution would be impossible. In a way, advertising is really a key to our industrial progress. Many industries owe their growth directly to the power of advertising. The Machine Age means more things for more people, and advertising is its indispensable tool."

* * *

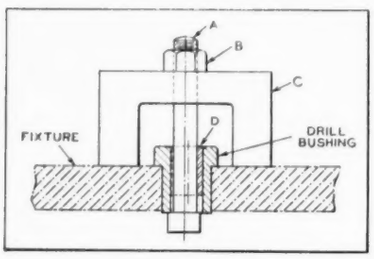
C. F. Kettering, vice-president in charge of research of the General Motors Corporation, says that incurable diseases are only those that the doctors do not yet know how to cure; and the engineering problems that are incapable of solution are simply those that the engineer does not yet know how to solve.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Device for Pulling Bushings from Blind Holes

In order to remove bushings from jigs and fixtures that have been mounted on machines, it is usually necessary to take the jig out of the machine. Bushings that have been pressed into blind holes or into holes in such positions that it is impossible to drive them out, can easily be removed by the use of the device shown in the accompanying illustration. In most cases, this can be done without taking the jig out of the machine.



Method of Using Bushing-Removing Device

In using this device, the head of bolt *A* is passed down through the hole in the bushing. The eccentric bushing *D* is then placed over bolt *A* and pushed down into the bushing to be removed. Bridge *C* is next slipped over bolt *A*. Nut *B* is then threaded on bolt *A* and tightened against bridge *C* to withdraw the drill bushing.

Racine, Wis. PAUL HADER

Kinks for Bolts Used in T-Slots

When only plain type bolts are available for use in the slots of a drilling machine table, faceplate or angle-plate, they can be prevented from turning by using a special washer made as shown at *A*. The tongue on the top of the washer prevents it from twisting when the nut is tightened or loosened.

A kink for holding two bolts in a fixed position in a T-slot after the work has been released ready for another clamping is shown in the view at *B*. When two bolts are used in the same positions repeatedly for clamping purposes, much time and trouble are saved by this arrangement, which prevents them from falling or slipping out of position on the table. This kink is particularly useful when the clamping bolts are used on the vertical face of an angle-plate. F. H.

Locating Pipe Connections to Avoid Breakage from Machine Vibrations

Pipes, fittings, and other members connected to machines subject to vibration are frequently broken as a result of crystallization in the metal caused by the vibrations. Failures of this kind occur most frequently in pipes or fittings that are connected to the machine at a point too far from its base.

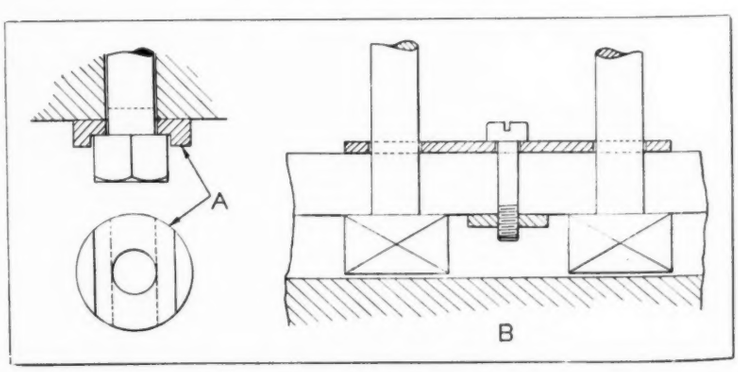
The amplitude of vibration is always least at the foundation and greatest in the parts of the machine that are farthest from the foundation, as in the case of a tuning fork. Thus, for instance, the vibrating movement at the top of a lathe or milling machine is greater than it is at the base. The logical place for connecting pipes, cables, ducts, etc., therefore, is near the foundation of the machine. This applies also to connections of metallic or non-metallic flexible pipes which are made especially to resist vibrations, because even such pipes have bending limitations.

Newark, N. J. W. F. SCHAPHORST

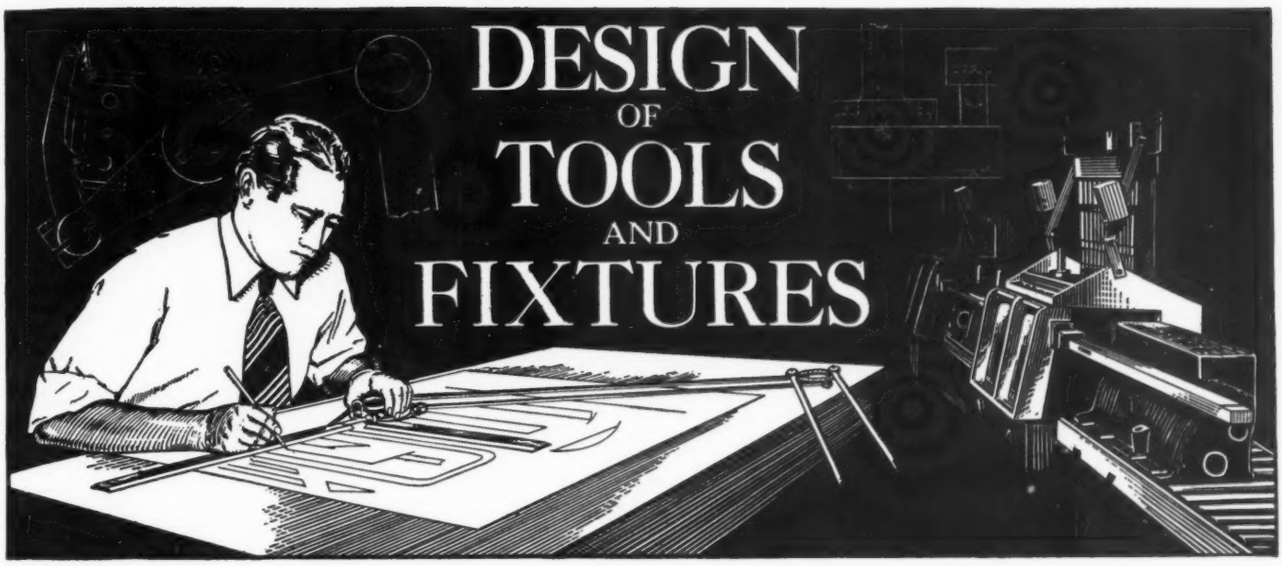
* * *

Unusual Accuracy in Shafting Sizes

An interesting example of exceptional accuracy in long shafts was recently called to our attention. The Cumberland Steel Co., Cumberland, Md., furnished to a machine tool builder a number of 5-inch diameter shafts, each 62 feet 8 inches long, which were accurate in diameter within a tolerance of 0.002 inch for the entire length. In other words, the limits of accuracy specified were between exact size and 0.002 inch under size. The length of these bars was approximately the same as the height of a six-story building, which makes the accuracy achievement all the more unusual.



Kinks for Using Bolts in T-slots

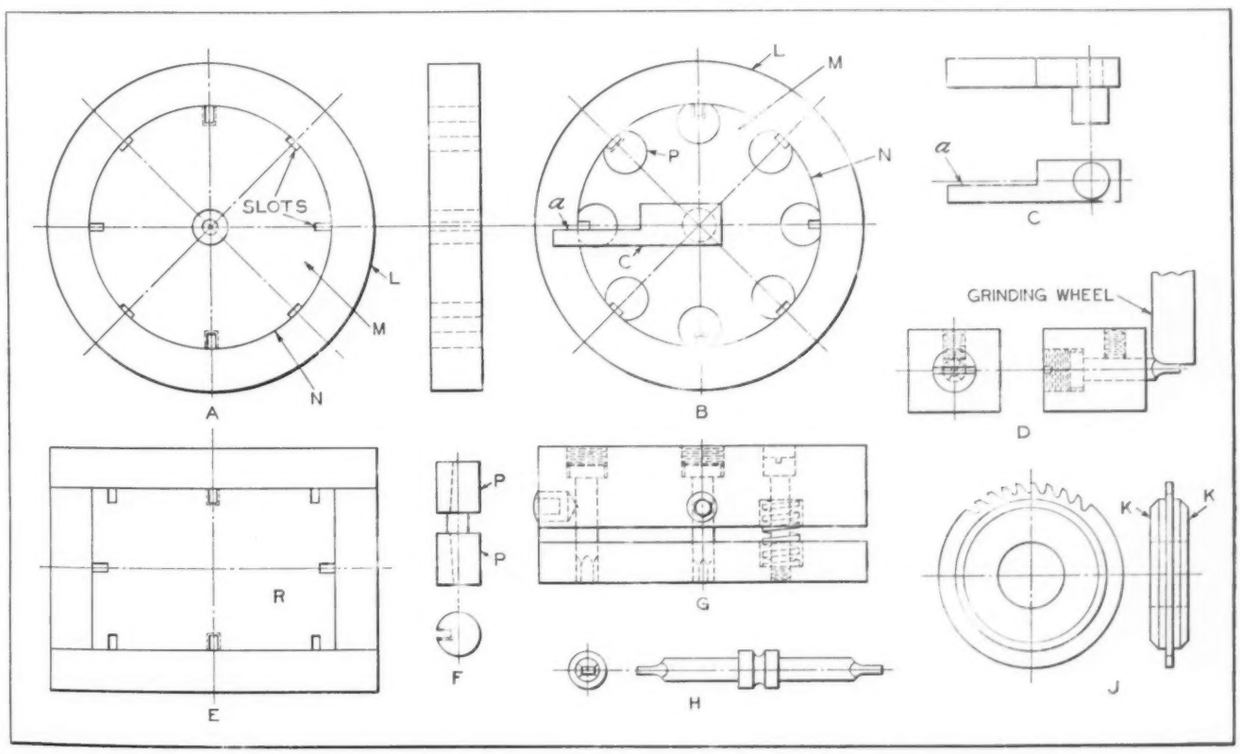


Method of Constructing Multiple Piercing Dies

By WILLIAM C. BETZ, New Britain, Conn.

One of the most accurate and economical methods of spacing the slots in round or rectangular dies is shown in the accompanying illustration. The eight rectangular slots in the die shown at *A* are accurately spaced by an indexing head. The slots are sawed or milled, their exact depth being easily determined by measurement. Clearance can be provided at the bottom of each slot by taking the milling cuts at the proper angle. Side clearances are filed on the slot walls. The saw used for cutting narrow slots should be provided with supporting flanges such as shown at *K* in view *J*.

The die *A* is made in two parts—the outer ring *L* and the slotted disk *M*. After disk *M* has been slotted and the clearance has been filed on the slot sides, both the disk and the ring are hardened. These members are then ground to give a light drive fit at *N*. This completes the die, with the exception of grinding the face and bottom of the assembled members. The spacing of the holes in the punch-holder and shedder shown at *G* is the



Diagrams Illustrating Methods and Equipment Used in Making Piercing Dies

next step, and is performed on either a jig borer or a very accurate indexing table, using a milling machine having a vertical attachment.

Another method of producing accurately spaced slots which permits repairs to be easily made in case of damage to one of the slots is the use of slotted buttons like the ones shown at *P*, view *B*. The holes for these dies are bored near the edge of the inner disk *M*, which is left soft. The button dies *P* are made in pairs, as shown in view *F*, to facilitate turning, slotting, and grinding. In this type of die, the disk *M* is made large enough to allow the holes for the button dies to be accurately bored.

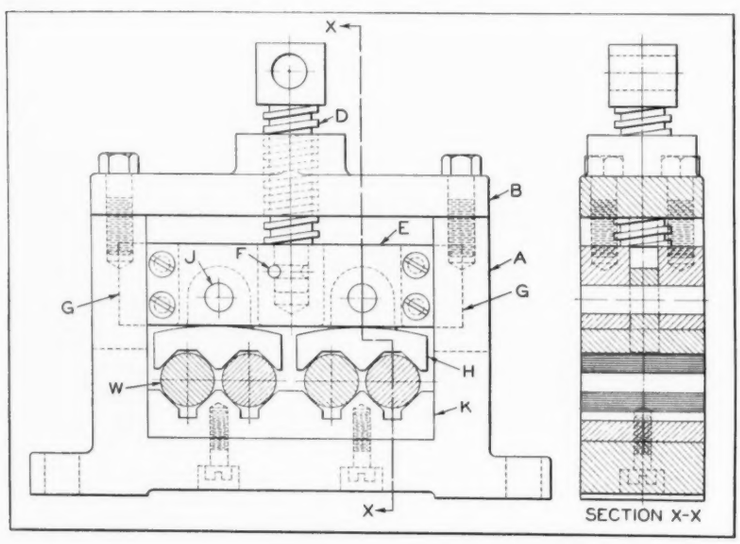
After the button dies are pressed into place, disk *M* is ground to a tight fit in the ground bore of ring *L*. The grinding operation on disk *M* leaves the ends of the slots next to the ring nearly flat, the surface being ground to the radius of the disk. This flat surface also serves to prevent the die buttons *P* from turning in disk *M*.

The gage shown at *C* is used in the manner indicated in view *B* to insure the accurate location of the slots in a given position relative to the center line of the die. Gage *C* consists of a rectangular steel piece with a stud which fits the center hole of disk *M*. The edge *a* of the gage is so machined that when the stud is placed in the center hole in disk *M*, edge *a* will be located at the correct angle for positioning the slot. A piece of metal inserted in each alternate slot serves as a locating stop against which the edge of plate *a* is rested when pressing the button dies *P* into disk *M*. After the button dies, disk *M*, and ring *L* have been assembled, the top and bottom of the die are ground.

The gage *C* is also used to set the punches in their correct positions relative to the die slots. The dimensions are then checked with a micrometer, taking measurements over the punch corners. Finally, the corrected punch assembly is tried in the die to make sure that the slots register properly with the punches.

When all the holes are accurately spaced in the dies and punch-holder, the next step is to carefully machine the punches, taking special care in the grinding operation. Any method of soft machining may be employed, but the grinding of the rectangular end in relation to the shank must be done with great care. One method is to make an accurate block *D* having a hole bored through its center, which is a push fit for the punch shank. This block is ground accurately on an arbor, so that opposite sides are equally spaced from the center and so that equal amounts are ground off each face of the punch between each adjustment of the wheel-slide. This serves to keep the ground end of the punch accurately centered. The grinding is done by simply turning the block over on each of its four sides, using the magnetic chuck on the surface grinder to hold the block in place.

Piercing slots can be made in rectangular or square dies as shown at *E*. The slots can be milled in the center die piece *R* or the piece can be bored and fitted with inserted button dies. Care must be taken not to cut the slot so deep that it will collapse when the button is pressed into the holder. The slot should not be machined closer to the center of the button die than 1/16 inch. The button dies should be made from non-deforming steels if possible.



Multi-jaw Vise with Equalized Clamping Arrangement

Multi-Jaw Vise for Cutting-Off or Milling Operations

By VINCENT WAITKUS, Baltimore, Md.

Frequently it is desirable to speed up cutting-off and milling operations by clamping several pieces in one vise. This usually results in a more uniform product and permits the workman to devote more time to other operations. The vise shown in the accompanying illustration was designed to hold four pieces *W*, but vises embodying the same design principles can be made for holding a larger number of pieces. A vise for holding eight pieces, for example, would consist of two units like the one shown in the illustration connected by an equalizing bar pivoted to the two jaw-holders.

The object is to so design the vise that a uniform clamping pressure will be exerted on each piece. The main body *A* of the vise is provided with a cover *B*, fastened in place by four cap-screws. The cover carries the clamping screw *D*, the lower end of which is fastened to jaw-holder *E* by pin *F*. A groove at the end of the clamping screw where the pin *F* is located permits the screw to rotate freely, and yet remain attached to the jaw-holder.

The jaw-holder is guided in a vertical plane by shoes *G* which slide in slots

machined in the body *A*. The jaws *H* are fastened to holder *E* by pins *J*, on which they pivot. The lower jaw *K* is secured to the main body of the vise by screws, and can be readily replaced when worn.

The pressure exerted by tightening screw *D* is transmitted through the jaw-holder to pins *J*. Pins *J* are equidistant from the tightening screw, so that they exert an equal pressure on the two jaws *H*. The two grooves in each jaw are also located the same distance on each side of pin *J*. Slight irregularities in the dimensions of the pieces are compensated for by the free movement of the jaws allowed by this construction.

Special Micrometer for Measuring Armature Journals

By ALBERT M. THOMAS, Toolmaker
Coney Island General Repair Shops
Brooklyn, Manhattan Transit Co., New York City

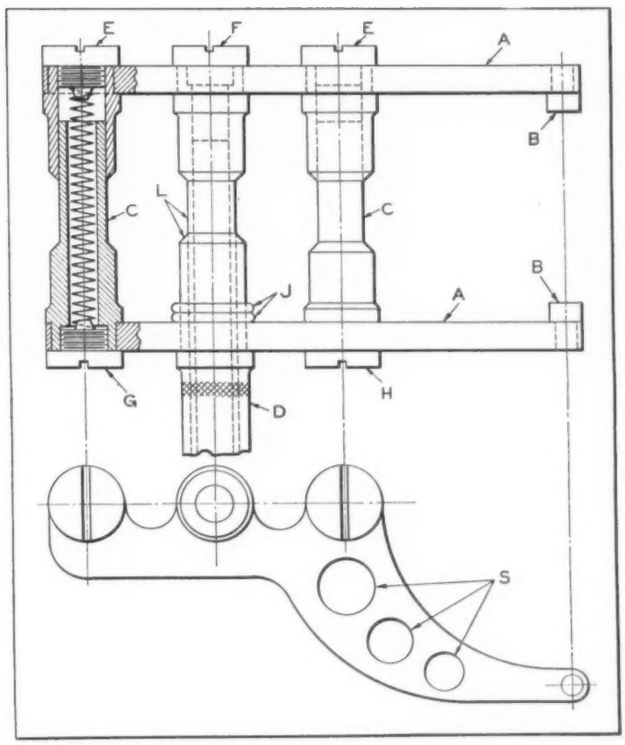
The accompanying illustration shows a 4- to 5-inch special micrometer developed in the tool-room of the Coney Island General Repair Shops of the Brooklyn, Manhattan Transit Co., where it is now being used in checking the parallelism of remachined armature journals of motors used in subway and elevated cars. Motors that are returned to the shops for repairs after extended periods of use, besides requiring rewinding, are invariably found to have the journals of their armatures worn out of parallel so that they must be remachined to obtain accurate bearing fits.

The windings of these armatures are so constructed that the ordinary micrometer cannot reach down to the part of the journals nearest the oil-rings for checking the refinished diameters. When the journals are remachined on an engine lathe that has been in service for some years and consequently shows wear on the ways and cross-slides of the saddle, careful checking of the work is necessary to insure the parallelism required for proper bearing fits.

The bars *A* of the micrometer shown in the illustration are exact duplicates and are made of the best carbon steel. They are produced with an offset, and are machined, hardened and ground. The holes at *S* serve simply to eliminate excess weight. The contact points *B* are made of the same material as the bars and have their faces hardened, ground, and lapped parallel.

The cross-bars *C* are of telescopic construction. As shown in the illustration, the telescoping members of the two cross-bars *C* are rigidly fastened to bars *A*. The inner members of bars *C* are made hollow to receive spiral springs which are held in place by the lock-screws *E*. Three additional locking screws at the points *F*, *G*, and *H* serve to hold the other members firmly in place.

The thimble *D*, only a portion of which is shown in the illustration, is held in place by the nuts *J*, the construction being the same as that of an ordinary micrometer. The graduations at *L* are the same as those on a regular micrometer, except that the range is 2 inches. All the telescoping parts are ground and lapped to close accurate fits. The springs placed within the two outer cross-bars *C* force the gage to register at the slightest turn or movement of the thimble *D*.



Special Micrometer with Offset Jaws for Measuring Armature Journals

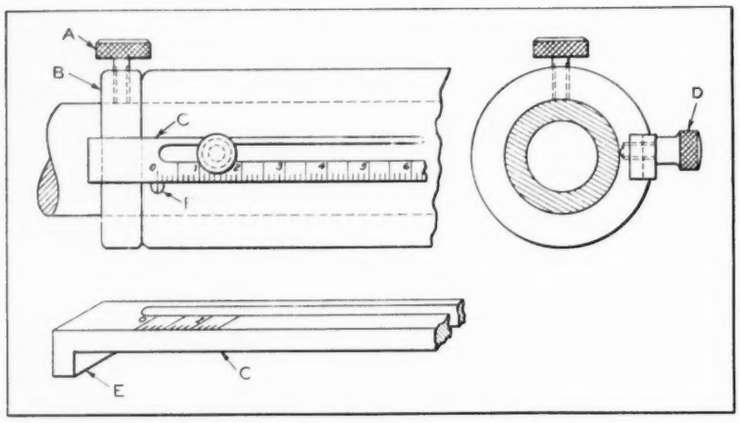
Lathe Tailstock Stop and Travel Indicator

By J. B. BOOTH, Bradford, Yorkshire, England

The depth gage attachment described on page 548 of April MACHINERY is useful in checking the depth of a drilled hole when the drilling is being done in a lathe. The writer has used a similar device constructed as shown in the accompanying illustration. This device not only indicates the distance the tailstock travels, but also serves as a definite stop for the tailstock when drilling holes to specified depths.

The illustration shows the tailstock spindle fitted with a steel collar *B* which is a snug push fit on the spindle. A knurled-headed brass screw *A* serves to clamp the collar to the spindle. The collar is slotted to fit the rule *C* as indicated. This rule is provided with a parallel slot which runs nearly the full length of the graduations engraved along one edge of the rule.

Clamping screw *D* passes through the slot in the rule member and is screwed into a tapped hole in



Lathe Tailstock Attachment for Gaging Depth of Counterbores and Drilled Holes

the tailstock casting. This permits rule *C* to be secured to the tailstock body. The rule member has a projecting stop *E* which bears against the side of collar *B*. A small indicating point *F* in the tailstock casting aligns with the zero mark on the rule when collar *B* is in contact with the front end of the tailstock.

In using this device, the counterboring tool is first advanced until it just scrapes the face of the work, after which collar *B* is pressed up against the tailstock spindle. The collar is clamped to the spindle in this position. Rule *C* is then adjusted toward the left and set to the depth of the counterbore required. The tailstock can now be fed into the work until collar *B* is brought up against the step or stop *E* on the under side of rule *C*. This attachment also serves as a depth gage in drilling.

Fixture for Gang-Milling Square Ends on Four Studs in One Set-Up

The neatly designed milling fixture described on page 852 of August MACHINERY is similar to a device developed by the writer several years ago for performing a slitting operation on the ends of short rods. These rods were also machined four at a time. The chief difference between the two fixtures is in the means employed for clamping the work. Instead of using a knurled-head clamping screw for each of the four studs, the writer employed the arrangement illustrated, which permits clamping all four pieces of work simultaneously by simply moving the lever *D*.

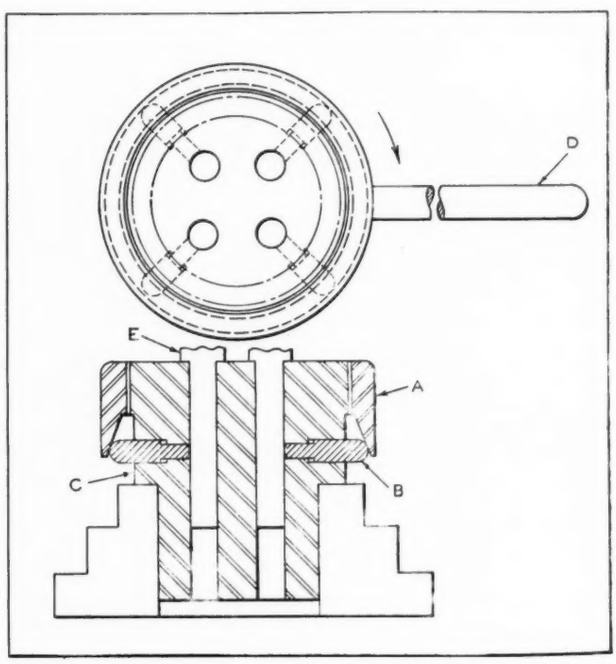
Obviously, when a large quantity of parts is being handled, the total time is considerably reduced if the clamping, as well as the releasing, of all four pieces of work is accomplished by one movement. The work, consisting of four studs *E*, is located in a cylindrical body *C*, one end of which is gripped in the chuck attached to the dividing head. The upper end of this piece is left slightly larger in diameter for a distance of 1 inch, this portion being threaded to fit the collar *A*.

The holes for the work studs are accurately located. Crosswise holes are then drilled into the work-locating holes to receive the plugs *B*. These holes are counterbored, as indicated in the cross-section view.

Collar *A* consists of a ring which is internally threaded for one-half its length to fit the thread on the end of body *C*. The remaining portion of the bore in collar *A* is enlarged and tapered as indicated. The wall of collar *A* is also drilled to receive the lever *D* by means of which the collar is rotated. The plugs *B* are simply pieces of cast-steel rod, rounded at each end, with their inner ends reduced to sliding fits in the holes in member *C*. These plugs are hardened and well polished on the rounded ends. Collar *A* is casehardened, and the surface of the conical bore is polished.

The studs *E* to be machined are dropped into the locating holes in body *C*. Collar *A* is then rotated in a clockwise direction until the conical bore makes contact with the rounded ends of plugs *B*, thereby forcing them inward so that they clamp the studs securely in place. When only light milling operations are to be performed, this method of clamping is satisfactory, but in cases where heavy cuts must be taken, it is advisable to provide a small pawl or catch that can be dropped over lever *D*.

It is, of course, also essential that the stud-holding holes be located on a circle concentric with the center of body *C* and that they be equally spaced on the circle. The plugs *B* must also be of exactly the same length to insure an equal clamping pressure on each stud. H. M. W.



Gang-milling Fixture Used in Dividing Head for Milling Square Ends on Four Studs

Checking Screw Threads and Helical Gears by Measurement Over Pins

In an article in the September number of MACHINERY, beginning on page 1, formulas were given for measuring worms and helical gears by the pin method. These formulas are as follows:

$$M = D + W\ (1 + \sin A) \qquad (1)$$

$$W = \frac{T \cos L}{\cos A} \qquad (2)$$

In these formulas,

M = measurement over pins for given diameter D;
D = pitch diameter or any diameter where width of thread or tooth space is known;
T = axial space width at D;
L = lead angle of helicoid at D, measured from plane of rotation or plane perpendicular to axis;
A = normal pressure angle at D = one-half included angle of cutter when thread is milled.
W = diameter of pins or wires.

According to this article, formulas (1) and (2) for screw threads may also be applied to helical gears. Such application, however, requires the following modifications:

$$M = D + W \qquad (3)$$

$$W = T_r \times \cos H \times \cos A \qquad (4)$$

in which T_r = width of tooth space in plane of rotation and on arc of circle of diameter D; D = any diameter where width T_r is taken, as, for example, the pitch diameter; H = helix angle at D relative to axis of gear; and A = normal pressure angle at D.

Formulas (1) and (2) give an exact solution when applied to screw threads having a straight-line profile in the axial plane (screw helicoid). If the screw thread is milled or ground with a cutter or wheel having a straight-line profile, a small error will be introduced in applying Formula (1). This is because any departure from a straight-line profile in the axial section will affect measurement M. This error, however, usually is small enough to be negligible in actual practice.

The error is affected somewhat by the diameter of the milling cutter. A milling cutter of small diameter produces a thread that is closer to a screw helicoid than a cutter of larger diameter; hence the error in measurement is less with the smaller cutter, because the thread profile in the axial section is closer to a straight line. With the cutter diameters ordinarily used, measurement M as obtained by Formula (1) is a close approximation. When the axial section of a screw thread is a straight line, contact with the pins or wires will be in the axial plane, and in all such cases Formula (1) gives the exact measurement.

The profile of a helical gear in its plane of rotation is an involute, and its profile in the axial section is a convex line. This is the involute helicoid. The form of milled or ground threads produced with a cutter or wheel having a straight-line profile is somewhere between the limiting cases of a screw helicoid and an involute helicoid. The contact between measuring pins and helicoids of forms varying from screw helicoids to involute helicoids (many such being developed by thread milling) will be somewhere between these two limiting cases.

If a cylindrical pin or wire is placed in the groove or space of a screw helicoid, the points of contact, as previously mentioned, will be in the axial plane of the helicoid. If a ball is placed in the space of a screw helicoid, the contact will be at points substantially normal to the helix at the diameter of the center of the ball; hence, in the case of a screw helicoid, measurements over cylindrical pins are different from measurements over balls.

If a pin is placed in the space of an involute helicoid, the contact between the pin and helicoid will be at points normal to the helix at the diameter of the center of the pin. The contact between a ball and the involute helicoid will be identical to that of a pin or wire of the same diameter. Thus, a measurement over pins is the same as a measurement over balls only in the case of an involute helicoid.

EARLE BUCKINGHAM

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Tool Engineers Plan Detroit Exhibition

The American Society of Tool Engineers, 2567 W. Grand Blvd., Detroit, Mich., has announced that the Society will sponsor a Machinery and Tool Progress Exhibition in Detroit, March 14 to 18, 1939. The 1938 show proved such a success that it hardly comes as a surprise that the Society should plan to have a similar show next year. At the show held in March, 1938, in Convention Hall, Detroit, there were 162 exhibitors of machines, tools, and production equipment; 23,755 persons visited the exhibition.

Because of the applications for space already received, the committee having the exhibition in charge has decided to make available, this coming spring, three times the amount of floor space used at the last exhibition. Frank Shuler, master mechanic of the Chrysler Corporation and past-president of the American Society of Tool Engineers, is chairman of the committee in charge of the show. The annual convention of the Society will be held simultaneously with the exhibition.

* * *

The owners of automobiles and motor trucks today pay in taxes one out of every seven dollars paid in the United States. The tax bill paid by car and truck owners exceeds by more than $200,000,000 the total factory value of new cars and trucks sold in the United States annually.

Casting Iron in Cement Molds

The Application in the Iron Foundry of a Process Used Heretofore in the United States for Steel Castings Principally

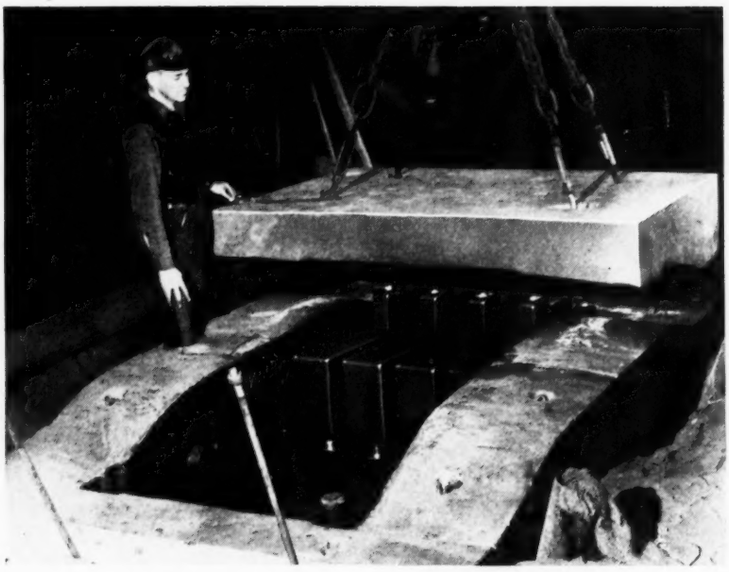


Fig. 1. Typical Cement-bonded Mold Used for the Production of an Iron Casting by the Randupson Process. The Mold is of Sectional Construction to Permit Removal of the Pattern

THE Randupson process of casting molten metal in molds that are bonded with cement has been used for several years in the United States principally for producing steel castings. The successful application of this process led the American Saw Mill Machinery Co., Hackettstown, N. J., to adapt the process to the production of iron castings. This concern has already produced a considerable tonnage of cement-molded alloy iron and gray iron castings for use in machinery of its own manufacture, and also for supplying to other concerns on a jobbing foundry basis. An outline of the practice followed by the concern mentioned will be given in this article. This concern is, of course, licensed by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., which is the sole agent for the process in the United States and Canada.

The Randupson process, which was developed in France, is based on the principle of using molds made from high-grade silica sand and cement, mixed in certain proportions. Clear water is added to obtain a light mixture. This mixture is rammed around the pattern in the customary manner, and after the pattern is drawn, the small molds are allowed to dry in the shop atmosphere for forty-eight hours, while the large ones are permitted to set for seventy-two hours. At the end of these periods, the molds are firm enough to insure that sharp corners and intricate details of the pattern will not crumble away when molten iron is poured into the mold. It is rarely necessary to use nails on the faces of the mold. Wet blacking is brushed or sprayed on all surfaces, in order to prevent the molten metal from burning into the mold.

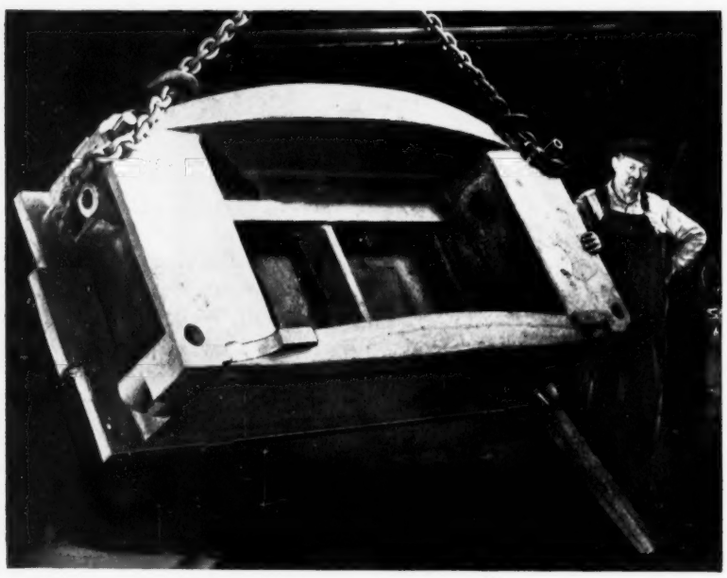


Fig. 2. Large Casting which Illustrates the Smoothness of Surface and Sharpness of Corners Obtainable through the Use of Cement-bonded Molds

A large mold with some of the cores in place is shown in Fig. 1. One-half of the cope, or top of the mold, is being lowered into place by means of a crane. The sectional construction of the mold is necessary for the withdrawal of the pattern. A paste is applied at the different joints of the sectional mold to hold them together during pouring.

Numerous advantages are claimed for the cement-mold method of producing iron castings. Of primary importance is the high quality of the castings. Because the mold walls and corners stand up firmly, the sand is held in place and is not cut by the molten iron. This feature of the process is emphasized by the fact that when a casting is taken from the mold, the marks of the brush used in applying the blacking to the mold faces can be readily distinguished on the casting surfaces. Castings are, therefore, produced with surfaces so

smooth that even snag grinding is not required in many instances when parts are to be assembled together, and obviously, the amount of stock left for machining can be materially reduced. The smooth surfaces also effect economies in the cost of painting the castings.

Blow-holes are eliminated in castings made by this process, due partially to the fact that the mold is sufficiently porous to allow steam or gas to escape through the walls. Gas is practically eliminated, however, because of the fact that the cement bond is an inert material.

The strength of these cement-bonded molds enables castings to be produced to unusually close foundry tolerances. For example, a piece weighing 3 tons was recently cast to a width of 61 3/4 inches within a variation of only 1/4 inch. The casting was approximately 72 inches long. The time required for cleaning castings made by this process has been reduced from 50 to 60 per cent, in comparison with green sand castings, and snagging has been reduced practically as much.

Because of the various advantages mentioned, the cement-mold process lends itself readily to the casting of gear teeth. Gears come from the molds with the teeth ready for use, no grinding or filing being required.

The inherent strength of these cement-bonded molds does away with the necessity of using flasks, and thus effects a tremendous saving for a jobbing foundry, because the flask for a large casting often costs as much as $500. Instead of making a large mold in a flask, it is prepared in wooden forms and set on a flat plate to dry. Iron rods are used longitudinally and transversely in the molds for reinforcement purposes. Hooks are rammed into the mold to facilitate handling with cranes, which can be done without any danger of breaking after the molds have dried out and the forms have been knocked off.

All cores that can be easily knocked out are made from the cement mixture. They are dried in the air, the same as the molds, and the need for a core oven is, therefore, eliminated. Small- or medium-sized cores do not require reinforcing rods and hold closely to size. Cores that cannot be removed from castings in one piece are made from oil and sand.

The cement molds can be used only once, but after the casting has been produced, the used mold can be broken up with sledge hammers and the lumps of the old mold can be put through a hammer mill; then, after removing the "fines," the sand can be used again for facing or backing up.

Iron castings of high tensile strength, as well as

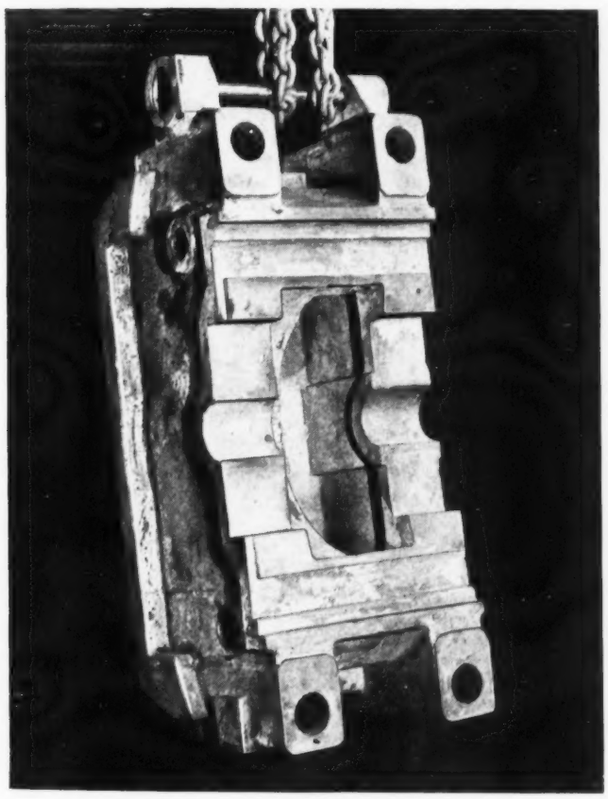


Fig. 3. Nickel Alloy or Iron Casting Produced by the Randupson Process, with Tensile Strength of 50,000 Pounds per Square Inch. Sharp Corners and Smooth Surfaces, in Addition to the Elimination of Sand in Castings, are Advantages Derived from This Process

Fig. 4. Large Nickel-Molybdenum Alloy Iron Casting as it Came from the Mold, with the Cores and Chaplets Still in Place. Note the Clean Smooth Surface which has not been Sandblasted. Test Bars Showed the Tensile Strength to be 55,000 Pounds per Square Inch

ordinary gray iron castings, are produced by this method at the plant mentioned. For instance, the casting shown in Fig. 2 is a nickel alloy casting having a tensile strength of 50,000 pounds per square inch. The casting seen in Fig. 3 is also a nickel alloy casting weighing 12,670 pounds, with a tensile strength of approximately 50,000 pounds per square inch. In Fig. 4 is shown a nickel-molybdenum alloy casting with the cores still in place. This casting weighs 12,435 pounds and has a tensile strength of over 55,000 pounds per square inch.

Through the proper use of various alloying elements, principally nickel, molybdenum, and chromium, the company is also furnishing castings that have exceptional heat resisting ability and unusual hardness, and, at the same time, retain machineability and high wear resistance. Many of these castings can be heat-treated after machining to obtain even greater hardness and wear resistance.

Castings can be made by this process with sections much thinner than those produced in regular foundry practice. This makes it possible to cast machine guards and similar parts of light weight. One casting that is produced in fairly large quantities is a machine pedestal about 3 1/2 feet high and 2 1/2 feet square. The walls of this pedestal are only 3/8 inch thick, but they are of such uniform section that the required strength is insured. Castings made by the cement-bonded process are generally lighter than ordinary sand castings, due largely to the fact that there are no bulges or swells as a result of mold walls giving way when the metal is poured. Weight savings are also realized from the fact that less stock need be allowed on surfaces later to be machined. Savings in weight have run as high as 10 per cent.

The Randupson process can also be applied for producing castings from aluminum, brass, and bronze.

* * *

Belting Withstands Severe Test by Floods

Two Condor compensated belts, installed early in December, 1935, on two horizontal water-wheel drives at Prospect Mills, Inc., Lawrence, Mass., were under water for five full days last September when part of the Prospect Mills plant was flooded after the New England hurricane. Yet it is stated that there was no necessity for repairs or adjustments to the drive by the user, and that the belts ran satisfactorily after the water receded. The same two belts, which are made by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., were submerged twice before in the floods that occurred in March, 1936. At one time they were under as much as seven feet of water for five days, and a second time under twenty feet of water for twelve days. All that was necessary before putting them back to work was to dry, clean, and dress them; other belts in the plant, it is stated, could not be reclaimed.

New Book on Machine Tool Testing

TESTING MACHINE TOOLS. By G. Schlesinger. 66 pages, 8 1/2 by 11 inches. THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $3.50.

This is the second, revised edition of a book containing fifty-three illustrated machine tool inspection charts showing the different tests and permissible errors for various classes of machine tools. The tolerances specified are accepted as a standard basis of quality in Germany, Russia, Italy, Switzerland, Belgium, Holland, Poland, Hungary, Czechoslovakia and Scandinavia, as well as in many plants in Great Britain and France. Since 1927, over 200,000 machine tools have been inspected according to these specifications. Constructive suggestions regarding the modification of some tolerances have been taken into account in preparing the second edition. The introductory section has also been amplified to make the specifications so explicit that there will be no possibility of misunderstanding.

The inspection charts cover various classes of milling machines, including thread milling machines; gear-hobbing machines; gear shapers; lathes; turret lathes; single-spindle and multiple-spindle automatics; vertical boring mills; cylindrical and surface grinding machines; tool and cutter grinders; drilling machines, including single-spindle, multiple-spindle, and radial machines; horizontal boring machines; planers; shapers; slotters; power presses; and punching machines.

The book is subdivided so that any section can be found readily. Metric figures are given on the charts, as in the first edition, but numerous conversion tables enable the user to readily obtain the inch equivalents.

* * *

Coming Annual Meeting of the American Society of Mechanical Engineers

The annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 W. 39th St., New York City, December 5 to 8. During this meeting, sessions will be held by a great many of the divisions of the Society. The Machine Shop Practice Division will have two sessions, one at 8 P.M., Monday, December 5, and one at 2 P.M., Tuesday, December 6. At the former session, two papers will be read relating to the application of hydraulics to machine tools; at the latter, papers will be read on the effects of the size and shape of a cut upon the performance of cutting fluids when turning, and on electric pressure gages.

A session on lubrication will be held at 2 P.M., Wednesday, December 7, when thin oil films, and wear as a factor in lubrication problems, will be discussed. A session on education and training in the industries will be held at 2 P.M., Thursday, December 8. A session on job evaluation will be held Tuesday, December 6, at 9:30 A.M.

Unusual Design of Swiss Internal Spline Grinder

AN internal spline grinder with an unusual drive for the grinding wheel has been developed by the Saurer Machine Co. of Zurich, Switzerland. The particularly interesting feature of this machine is that the grinding wheel is driven by a small turbine rotor mounted on the wheel-spindle and actuated by the soda water which serves as a coolant.

As may be noted in Fig. 2, a small turbine rotor is mounted beside the grinding wheel at the end of a hollow shaft or tube. Through this tube passes the piping for the soda water which, actuated by a pump, impinges on the turbine blades at considerable pressure. The pressure of the driving liquid, and, consequently, the speed of the wheel, can be regulated by a valve. The pump is mounted on the base of the machine, the base serving as a reservoir for the liquid, which is filtered and recirculated.

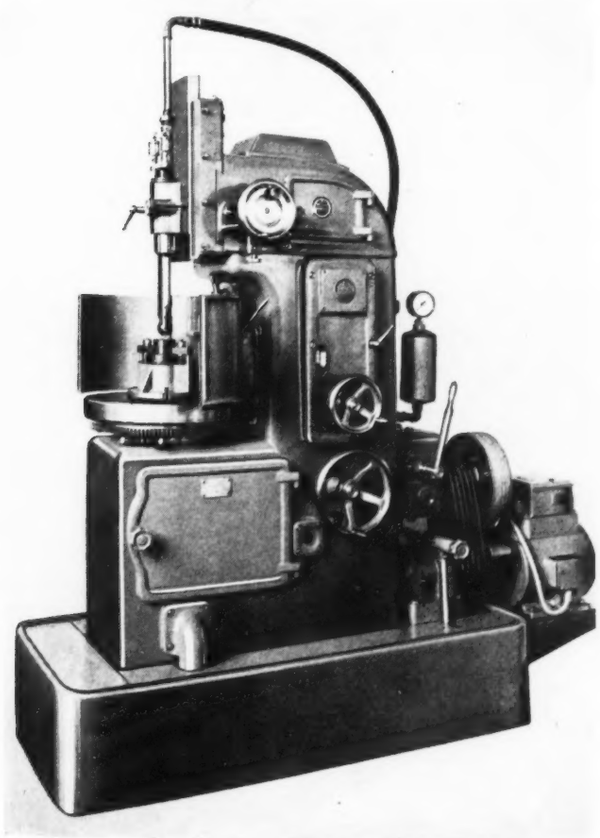


Fig. 1. A Swiss Internal Spline Grinding Machine of Unusual Design

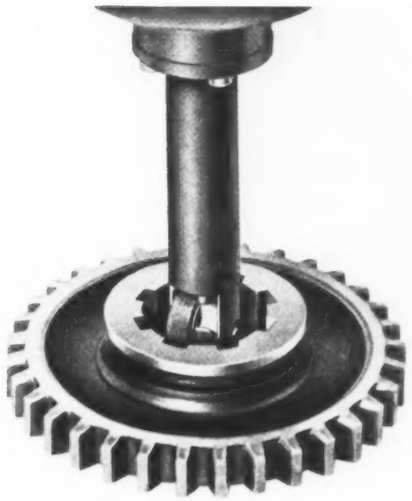


Fig. 2. Grinding Wheel Driven by a Turbine Rotor Mounted at the End of a Vertical Tube

The machine is designed to grind from four to twenty-four splines, either of square or involute profile, in bores varying from 3/4 inch to 4 11/16 inches in diameter and up to 7 inches long. For square splines, a cup-wheel is used, and for involute splines, the wheel has the profile of the spline. In either case, the machine is provided with a wheel-dressing device. Although the machine is primarily intended for production work, it can also be used for precision grinding of spline-shaft gages.

The grinding head is mounted in a vertical slide which reciprocates in ways on the front of the column head. On the down stroke of this slide, the wheel grinds one side of the spline. Before it starts on the up stroke, the wheel moves diametrically across the bore and then grinds one of the sides of the opposite spline. The wheel is fed against the spline side by a cross-slide. The feed can be regulated very closely by a graduated feeding wheel, either hand-operated or driven from the table by a cam-operated push-rod. The indexing change-gears, which are in mesh with the large ring gear under the work-table, turn the work automatically to the next spline.

Two handwheels, each provided with a graduated scale, are used to set the feed and the stroke of the grinding wheel across the bore. A clamping screw moving in a graduated slot inside the column head limits the vertical stroke. The mechanism is engaged by a shift-lever on the gear-box and is driven by a 3 1/2-horsepower motor.

When mounting a new piece of work, two screws under the work-table are used to align the splines with the gear teeth or bosses on the work. For production work, a circular flanged fixture bolted concentrically on the work-table is used for supporting the work, which is fastened with conventional clamps. The machine is sold in this country by W. A. Schuyler, 250 W. 57th St., New York City.

A Universal Welding Manipulator

Abstract of a Paper by J. O. Bishop, Master Mechanic, National Supply Co., Torrance, Calif., Who Received the Second Main Award in the Industrial Machinery Group in the Prize Competition Sponsored by the James F. Lincoln Arc Welding Foundation

THE device described in this article was built and is used in a large plant manufacturing oil-well drilling and production machinery. The machine is known as a "manipulator," and is used for handling or manipulating parts to be welded during the welding process. Its construction permits the parts to be rotated through a complete circle of 360 degrees in both the vertical and the horizontal planes, so that the work can be turned to any position that will provide for the greatest convenience of the welder. Its principal advantage is that it permits access to any part of the piece to be worked upon, either top, bottom, or sides, without resetting, after the part has once been located in the manipulator.

The more important units of the device are a foundation on which the machine is mounted, provided with clearance around and under the machine; pedestals on which the power-driven assembly is carried; a cradle with a driving motor and gears to provide rotation; a portable floor or platform to facilitate reaching the points on which the work is to be operated; a car with adjustable ladders to facilitate the approach to the work; and adequate motor control equipment.

Fig. 1 shows a general view of the manipulator in its idle position. *A* is the pit necessary to clear work 30 feet in length; *B* is a combination cradle-plate and cradle-rotating gear mounting; *C* is the companion cradle-plate; *D* is a roller-bearing housing mounted on a sub-base *E; H* represents the tubular-frame cradle members upon which are mounted a turntable ring *I* by means of four retaining rollers *J*. On the top of the turntable are a number of clamps employed for holding the work on the table, while at *M* is located the turntable drive-shaft. A movable working platform mounted on three wheels is shown at *K*.

In Fig. 2 are shown some of the other features of the device. The car *O* travels on the rails indicated at *N*. On this car is the swivel plate *P* which supports the adjustable ladders *Q*. The ladders can be lowered or raised to an angle of 60 degrees, either below or above a level position.

The turntable is unique in several respects. In the first place, it was difficult to secure plates of sufficient dimensions to make the two rings 146 and 147 inches in diameter. Hence, these rings were made by welding together six sectors for each ring. Relatively true and flat rings were obtained by carefully laying out the sectors and cutting them on a shape-cutting machine, after which the ends of each sector were chamfered on both sides of the plate, tack-welded, and then completely welded together, being frequently turned over to prevent shrinkage and warpage.

After two of the sectors were welded together, a third was attached in a similar manner. This three-sector half was then laid aside and the other half of a ring constructed. The welded joints on the halves were next rough-ground by hand-grinders, so that the ring halves could be straightened by heating while resting on a surface plate. Then the two halves were brought together and welded, and the last joints rough-ground by hand. After both rings were welded, they were stress-relieved, and then machined.

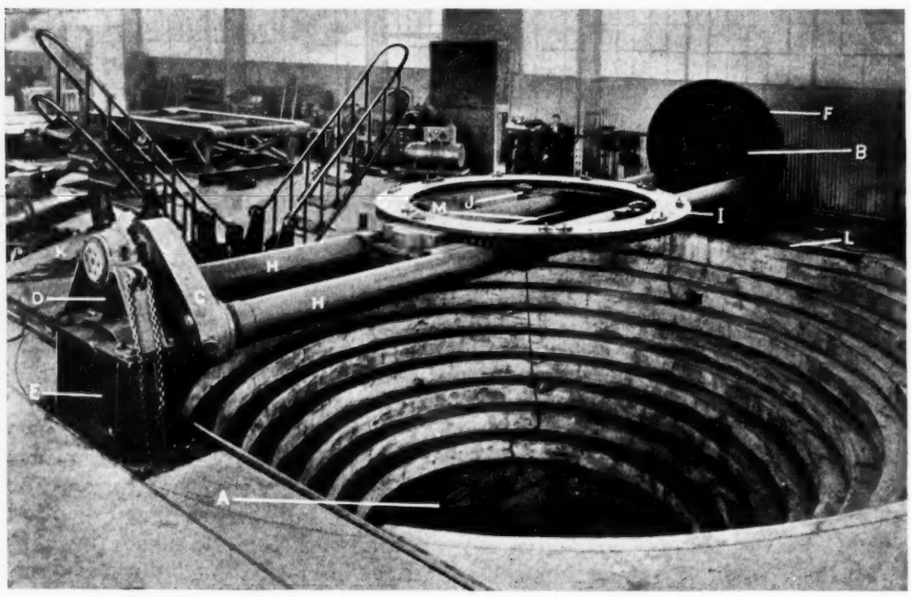


Fig. 1. General View of the Welding Manipulator with no Work in Position

In operation, the machine is first brought to a level position, as shown in Fig. 1, and hold-down clamps and screws are removed. The work, having been cut and then fitted and tacked on a surface plate, is lifted and placed on the turntable by means of an overhead crane. Usually it is possible to so locate it that no welding zones on the under side are obstructed by the turntable ring or cradle tubes. The work is then securely bolted in place by the clamps and screws, and the operator checks it to ascertain that the tacking is heavy enough to permit the work to be turned over with safety.

Usually there are a number of horizontal or so-called "down-hand" welds to be made, after which the work is rotated in either one or both planes to bring the other welding zones into position, so that all the joints can be welded in a flat or "down-hand" position. This procedure permits of as high temperatures as good practice dictates, and at the same time the operator can use the largest practicable electrode. After the welds that can be made in one position have been completed, the operator steps away, removes the rolling platform, rotates the work to a new position, and proceeds as before.

The total cost of the building and installation of the manipulator was $5380. By its use, a great deal of time has been saved as compared with former methods, when, because of the difficult access to the point of welding, an inefficient electrode and reduced heat were, by necessity, used. The estimated saving in dollars and cents due to the use of the manipulator is very great. It has been estimated that the device saves over $40,000 a year. This is a very attractive annual return on an investment of less than $6000.

As an example of work performed by means of the manipulator, the frame assembly in Fig. 3 is shown. The over-all dimensions of this frame are, length, 18 feet; width, 7 feet 9 inches; height, 7 feet 8 inches. The white lines indicate the welds.

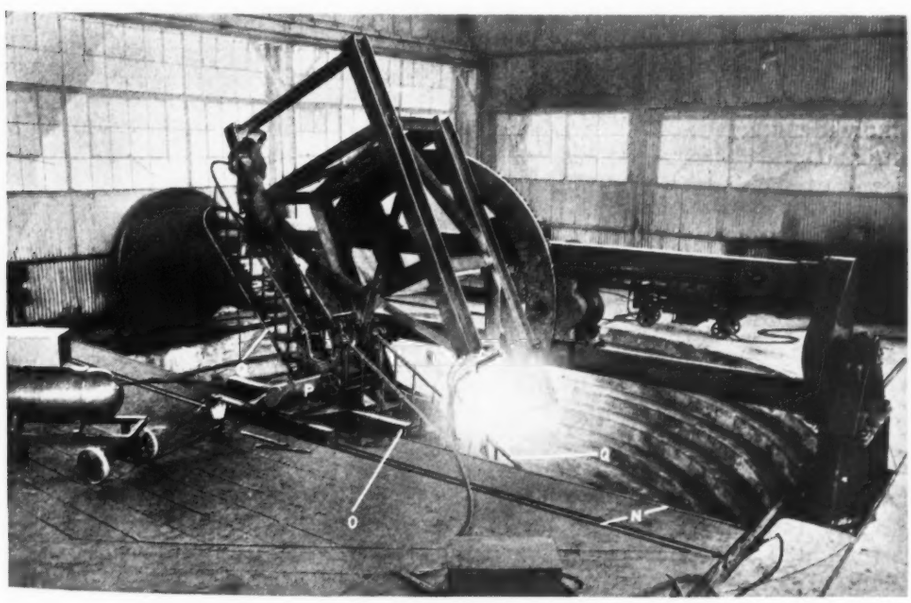


Fig. 2. The Welding Manipulator with a Frame Being Welded Mounted on It

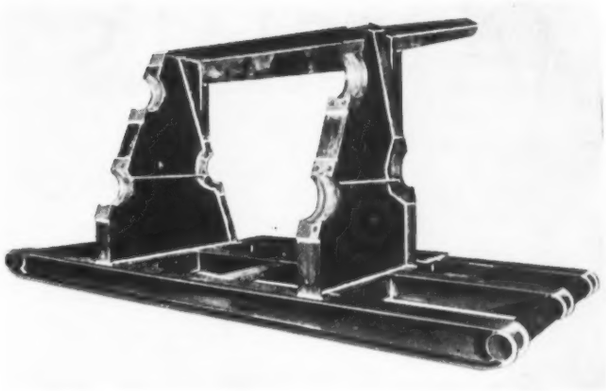


Fig. 3. A Frame 18 Feet Long and Nearly 8 Feet Wide and High Welded by the Use of the Manipulator. The White Lines Indicate the Welds

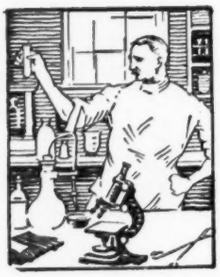
The present manipulator has several advantages over those generally used in the past. The usual limitations of these have been that less than a complete revolution in at least one, if not more than one, plane is possible, and that they are usually of the solid platen type on which the work must be rehandled by a crane to present the reverse side of the part to be welded. In addition to economy and convenience, this manipulator also lays claim to improved quality of workmanship in the welds, due to the fact that nearly all welds can be made by the "down-hand" method.

* * *

Meeting of Meehanite Research Institute

The Meehanite Research Institute held its annual meeting in Rochester, N. Y., the week of October 24. About forty-six research papers were presented on a variety of subjects, including "The Physics of Machining," by Hans Ernst of the Cincinnati Milling Machine Company. O. Smalley, president of Meehanite Metal Corporation, Pittsburgh, Pa., was re-elected president; H. B. Hanley, foundry manager of the American Laundry Machine Co., Rochester, N. Y., vice-president; and F. M. Robbins, president of the Ross-Meehan Foundries, Chattanooga, Tenn., secretary-treasurer. Over sixty-five representatives of Meehanite licensees throughout this country, Canada, and South Africa attended the meetings and discussions.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Nickel-Iron Alloy for Parts Requiring Constancy of Dimensions

Nilvar, a trademarked nickel-iron alloy produced by the Driver-Harris Co., Harrison, N. J., has the lowest coefficient of expansion of any metal at temperatures up to 392 degrees F., and is therefore widely used for parts where constancy of dimensions must be maintained. It finds application, for example, in the manufacture of bimetallic strip, measuring tapes, length standards, etc.

Because of its relative immunity to size change with temperature variations over a wide range, Nilvar is being used in present-day radio equipment, such as tubes, wherein low expansion members are desired in maintaining frequency within very close limits, and rotor and stator plates of variable condensers in ultra-high-frequency equipment. 201

Variety of Materials Used in Modern Automobile Construction

At least nineteen different metals enter into the chassis and engine of an automobile, either directly or as alloys. These are aluminum, antimony, barium, brass, bronze, cadmium, chromium, copper, indium, iron, lead, manganese, molybdenum, nickel, silver, tin, tungsten, vanadium, and zinc. Four-fifths of the weight of the modern automobile consists of metal products.

Rubber, however, is also an important material. More than 50 pounds of rubber per car is used, even in the smaller types of automobiles. From two to three hundred different kinds of rubber products are used in automobile construction, while at least five hundred different varieties of rubber goods and products find "non-productive" uses in automobile building plants.

The modern automobile uses very little wood; yet for each automobile built, more than 60 pounds of wood is employed in various ways, including the wood used for packing and shipping, and in the manufacture of fiber board and paper used both in manufacturing and shipping. Cotton plays an important part in the tires. About 100 miles of cotton yarn is required to make a typical pneumatic truck tire. The laminated safety glass now generally used in automobiles has created an industry all its own. In 1937, the automotive industry used 70,000,000 square feet of such glass. 202

Industrial Uses of an Unusual Material—Fiber Glass

During recent years, some remarkable developments have taken place in the glass industry, making it possible to produce fine silk-like threads and fabrics from glass. These fiber-glass products have many applications in industry. Glass is now being drawn into fibers that are only 0.0002 inch in diameter. It is said that there are no obstacles in the way of drawing them into threads very much finer —in fact, as fine as the finest spider web.

One of the applications of fiber glass is as an insulation in electric motors. Fiber glass will permit of substantial overloading of motors without damage to the insulating material, because of its high heat resistance. In experiments, motors have operated at temperatures far beyond those heretofore possible without short circuits or damage to the insulation. Because of the smaller bulk of insulating material, electric motors of a given horsepower have been constructed which are considerably smaller than those using other insulating materials. Motors operating at heavy overloads and under adverse atmospheric conditions are now being constructed with fiber-glass insulation.

Since the glass fiber is impervious to practically all acids, and unaffected by moisture, this new material promises to solve many industrial problems where other materials have failed.

One application for these glass fibers is found in pipe coverings for high-temperature and refrigeration lines. Fiber-glass blankets are used for steam turbines which operate at high temperatures. In airplanes, fiber glass is being used for sound insulation, and in modern heating and ventilating equipment for air filters. As a matter of fact, one of the first applications of the glass cloth was for air filters for heating and air-conditioning systems, where the glass fabric offers a low-cost air filter of

To obtain additional information about materials described on these pages, see lower part of page 284.

high efficiency. Other applications that may be mentioned are insulation in stoves and refrigerators, insulation in building construction, and protective covering for plants and shrubs in winter, fiber-glass blankets being deemed superior in several respects to other materials for this purpose. 203

Recently Developed Compounds for Cleaning Metal

A new water-soluble hydrocarbon which is intended for use in cleaning metals, and is said to be particularly effective on mineral oils, fatty substances, and soap, has been developed by the Quaker Chemical Products Corporation, Conshohoken, Pa., and is being introduced on the market under the designation Quaker TF-936. In machine shops, this compound can be used for removing all types of cutting, slushing, and quenching oils from machine parts before assembly, inspection, and placing in stock; for removing drawing compounds, cutting oils, and slushing oils from steel prior to bonderizing, enameling, lacquering, and painting; and for removing buffing compounds from polished steel, brass, copper and die-castings before lacquering or electroplating.

An advantage of this compound is that cleaning and rustproofing of work can be accomplished in one operation, an alkali-free surface being obtained that permits a good finish coat. The solvent can be used to prevent work from rusting when held on conveyor lines over week-ends or when placed in stock for a short period of time.

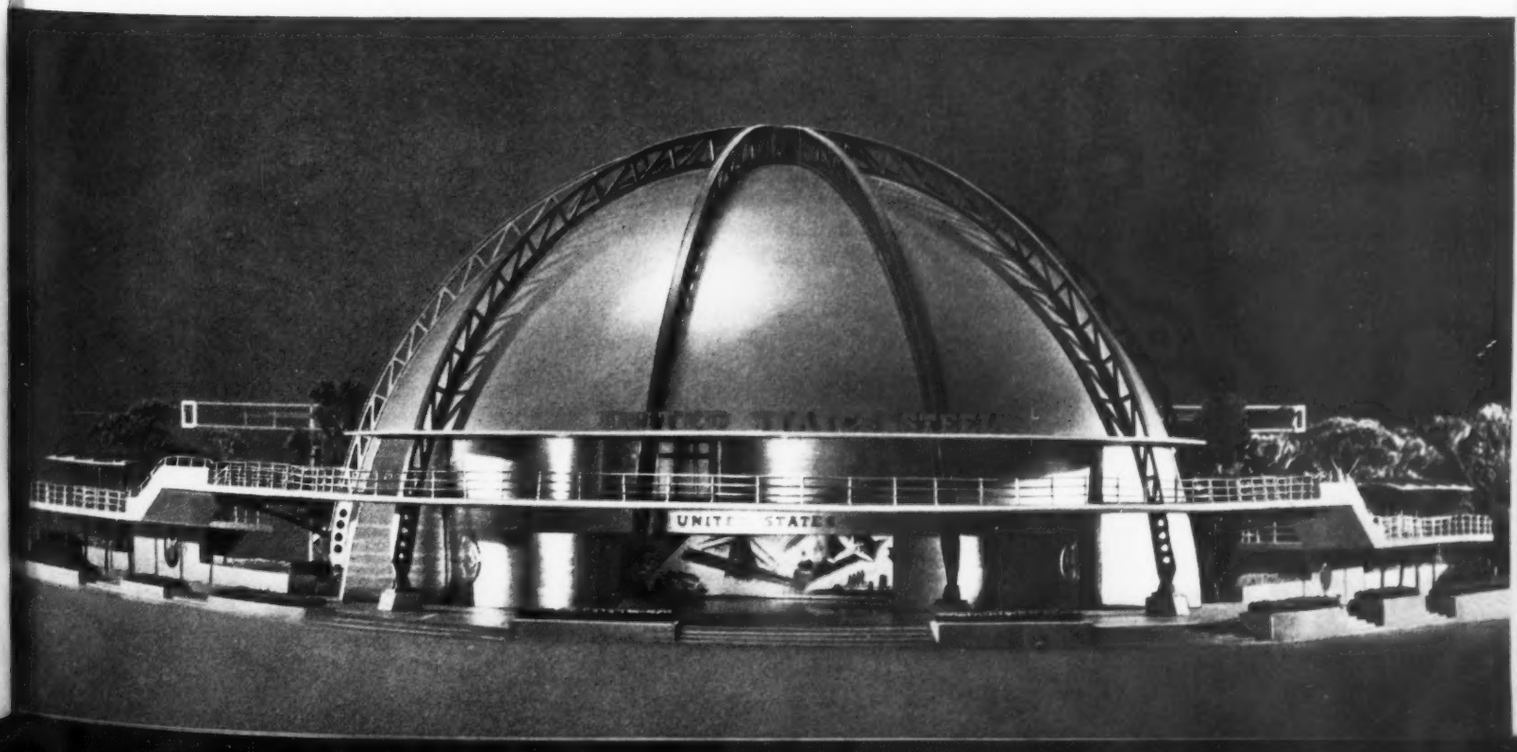
Galvanized metal, zinc die-castings, and alloys containing a large percentage of zinc can be cleaned and prepared for painting by the application of a compound known as "Galvo-Cleen," which is a recent product of the Nielco Chemical Co., Detroit, Mich. Oils, grease, and dirt are readily removed. This compound forms a bond that enables newly galvanized metal to be painted without a primer, the compound providing a non-reactive zinc-phosphate coating. 204

Coprtex Heat-Insulating Cement for High Temperatures

A heat-insulating cement suitable for high temperatures, which is known by the trade name "Coprtex," has been developed by the technical laboratory of the Armstrong Cork Products Co., Lancaster, Pa. The base material of this cement is a resilient long-fiber copper slag wool. The cement will bond with and stick to clean surfaces of any type of material. Its average adhesive strength is 30 pounds per square inch. It will withstand a maximum temperature of 2000 degrees F.

One advantage of this cement is that when it becomes necessary to make repairs or changes in steam lines, headers, boilers, or similar equipment, the Coprtex cement is reclaimable and can be salvaged, provided it has not been subjected to temperatures exceeding 1200 degrees F. It can be reused without loss of efficiency by mixing it with clean water. It is easily applied. This material has performed satisfactorily in a long series of tests, as well as in actual installations. 205

Stainless Steel and the Manifold Uses to which it can be Put Architecturally will be Featured by the U. S. Steel Corporation at the 1939 New York World's Fair. The Illustration Shows a Model of the Proposed Exhibition Building, which will be in the Form of a Hemisphere, 132 Feet in Diameter, Supported by External Arches



NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 283 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the December Number of MACHINERY.

Automatic Threading Dies and Taps

NATIONAL ACME CO., 170 E. 131st St., Cleveland, Ohio. Catalogue D-38, containing complete data on seventeen styles and ninety-five sizes of automatic threading dies and taps. The catalogue explains the application of Namco circular-chaser threading and hollow-milling heads for every type of production threading work. It also contains general information of value to the user of dies and taps. 1

Cleaning Materials and Industrial Safety

OAKITE PRODUCTS, INC., 26 Thames St., New York City. Booklet entitled "Greater Industrial Safety," pointing out the ways in which modern cleaning methods and materials provide increased safety of plant, product, and personnel. The booklet reviews effective ways to eliminate fire hazards, and discusses methods of avoiding certain occupational hazards and of safeguarding health. 2

Small Tools

BROWN & SHARPE MFG. CO., Providence, R. I. Catalogue 33, covering the complete line of B & S small tools, including cutters, hobs, screw machine tools, arbors and collets, and miscellaneous equipment. Several new products are shown in this catalogue for the first time. Tables and other data of value to the designer and shop man are included. 3

Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Bulletin 401-A, containing information regarding the proper procedure for producing all types of welds in mild steel; for welding all metals used industrially; and for applying surfacing metal to meet any type of wear action in service. Typical welding applications are illustrated. 4

Ball-Bearing Pillow Blocks

STEPHENS-ADAMSON MFG. CO., Aurora, Ill. Catalogue 7538, illustrating and describing the "Sealmaster" permanent-seal, self-aligning, ball-bearing pillow blocks intended for general machinery applications, which will hold the proper amount of lubrication and give full protection to the rolling elements. 5

Grinding Wheels and Machines

NORTON CO., Worcester, Mass. Booklet entitled "Disk Grinding—A Production Operation," containing information of value to users of disk grinders. Covering speeds, correct type of wheel to use for various classes of work, mounting instructions, etc. Pamphlet 1645-1P, treating of methods and wheels used in roll-grinding. 6

Iron and Steel

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. Condensed stock list and data book, containing a summary of products available for immediate shipment from Ryerson stocks. The book also contains an explanation of the change in steel classifications and extras, as well as general data tables of interest to steel users. 7

Self-Locking Set-Screws

STANDARD PRESSED STEEL CO., Jenkintown, Pa. Circular 530, illustrating and describing "Unbrako" knurled-point self-locking set-screws which, due to the knurled point, become securely locked when tightened, and which retain their locking qualities regardless of how often adjusted. 8

Pipe Threaders

RIDGE TOOL CO., Elyria, Ohio. Circular descriptive of the No. 65R and 85R series of pipe threaders with all-steel and malleable-alloy construction, designed for threading four sizes of pipe with one set of chasers. The circular also describes the new No. 1R series poster pipe threaders. 9

Screw-Cutting Lathes

RIVETT LATHE & GRINDER, INC., Brighton, Boston, Mass. Bulletin 608C, containing 32 pages describing the development of the Rivett 608 screw-cutting lathe and its many attachments, which adapt it for precision tool-room, laboratory, and production work. 10

Turret Lathes

BARDONS & OLIVER, INC., Cleveland, Ohio. Circular illustrating and describing the Bardons & Oliver 1-inch geared electric turret lathe with single lever controls. A complete list of the tooling equipment available for both bar and chucking work is included in the circular. 11

Laminated Synthetic Products

CONTINENTAL-DIAMOND FIBRE CO., Newark, Del. Catalogue containing information on the various grades and uses of "Dilecto," a laminated synthetic material possessing insulating properties, together with great mechanical strength and adaptability for fabrication. 12

Portable Pneumatic Tools

CHICAGO PNEUMATIC TOOL CO., 6 E. 44th St., New York City. Bulletin SP1851, covering a line of portable riveting tools, screwdrivers, etc., especially designed for airplane work, but which are also suitable for automobile work and other metal fabrication. 13

Roller Bearings

BOWER ROLLER BEARING CO., 3040 Hart Ave., Detroit, Mich. Engineering journal containing technical data, drawings, and other essential information relating to the mechanical design, processing, application, and functioning of Bower roller bearings. 14

Thread-Cutting Machinery

LANDIS MACHINE CO., INC., Waynesboro, Pa. Bulletin entitled "For the Ultimate in Modernization 'Landisize' Your Threads," showing applications of Landis automatic and semi-automatic threading machines and die-heads. 15

Measuring Instruments

PRATT & WHITNEY, DIVISION NILES-BEMENT-POND CO., Hartford, Conn. Circular illustrating and describing the Pratt & Whitney Supermicrometer, which measures directly to 0.0001 inch and has a measuring range of from 0 to 9 inches. 16

Tungsten-Carbide Work-Support Blades

CINCINNATI GRINDERS, INC., Cincinnati, Ohio. Circular G-422, describing Willey's tungsten-carbide work-support blades for Cincinnati Nos. 2, 3, and 4 centerless grinding machines. 17

Precision Lathes

SOUTH BEND LATHE WORKS, 724 E. Madison St., South Bend, Ind. Booklet 88, entitled "Modern Industrial Shops," showing examples of the use of South Bend precision lathes in the shops of well-known manufacturers in a variety of industries. 18

Milling Cutters

SEVERANCE TOOL MFG. CO., E. Genesee Ave., Saginaw, Mich. Bulletin 12-B, descriptive of Severance "Chatter-less" countersinks, combination inside and outside tube burring cutters, inside burring cutters, etc. 19

Speed Reducers

PHILADELPHIA GEAR WORKS, G St. and Erie Ave., Philadelphia, Pa. Bulletin MR38, on the Philadelphia "MotoReduceR," containing tables of dimensions of the various types, as well as tables of sizes for different speed reduction requirements. 20

Ball Bearings

NICE BALL BEARING CO., Nicetown, Philadelphia, Pa. Catalogue 106, containing tables of load ratings and other data covering the Nice line of ball bearings. Circular entitled "Cut Production Costs with the Proper Bearing for Your Job." 21

Heat-Treating Equipment

AJAX ELECTROTHERMIC CORPORATION, Trenton, N. J. Circular T4, entitled "Looking into the Future with Ajax-Northrup Furnaces," giving data showing how these furnaces have stepped up production in several specific installations. 22

Heat-Treating Equipment

SURFACE COMBUSTION CORPORATION, Toledo, Ohio. Circular describing how molybdenum alloy and other steels are heat-treated without decarburization in Char-Mo furnaces, no protective coatings or special treatment being required. 23

Combination Turning Tools

R & L TOOLS, 1825 Bristol St., Nicetown, Philadelphia, Pa. Circular descriptive of the R & L combination right- and left-hand turning tool which can be used in place of fourteen separate tools for performing several operations at one time. 24

Metal Stampings

DAYTON ROGERS MFG. CO., Minneapolis, Minn. Bulletin illustrating examples of the type of metal stampings produced by this concern in small quantities, with figures for each case, indicative of the low tool costs. 25

Shaving Machine

NATIONAL BROACH & MACHINE CO., Shoemaker and St. Jean Sts., Detroit, Mich. Catalogue illustrating and describing the Roto-Shaving machine for truing up and finishing bearing or locating surfaces preparatory to subsequent machining. 26

Electrical Tools

UNITED STATES ELECTRICAL TOOL CO., Cincinnati, Ohio. Catalogue 52, illustrating the full line of electrical tools for the industrial and automotive industries made by this company. 27

Industrial Vacuum Cleaners

UNITED STATES HOFFMAN MACHINERY CORPORATION, AIR APPLIANCE DIVISION, 105 Fourth Ave., New

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To Obtain Copies of New Trade Literature

listed on pages 282-284 (without charge or obligation) mark with X in the squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:

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York City. Booklet A-303, describing heavy-duty portable vacuum cleaners for industrial use. 28

Hard-Facing Rods

HAYNES STELLITE CO., Kokomo, Ind. Revised folder entitled "Hard-Facing with Haynes Stellite Rod (Oxy-acetylene Process)." Another folder gives data for hard-facing by the metallic arc process. 29

Zinc-Alloy Die-Castings

NEW JERSEY ZINC CO., 160 Front St., New York City. Booklet illustrating typical uses of zinc-alloy die-castings in industrial equipment, indicative of their wide scope of application. 30

Arc-Welding Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet 26-620, describing arc-welding equipment and supplies, including electrode-holders, helmets, protective clothing, etc. 31

Galvannealed Sheets

REPUBLIC STEEL CORPORATION, Cleveland, Ohio. Folder Adv-312, entitled "Why Should I Use Republic Galvannealed Sheets?" describing the advantages of these sheets and showing typical applications. 32

Face-Mill Grinders

OLIVER INSTRUMENT CO., 1410 E. Maumee St., Adrian, Mich. Bulletin describing the construction of the Oliver "Arc" face-mill grinder, which is made in both hand-operated and automatic types. 33

Toggle Clamps and Pliers

KNU-VISE PRODUCTS CO., 6426 Cass Ave., Detroit, Mich. Bulletin illustrating and describing Knu-Sine rapid-action toggle clamps and Knu-Lok toggle pliers, as well as spring gages. 34

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BRYANT MACHINERY & ENGINEERING CO., 400 W. Madison St., Chicago, Ill. Circular illustrating and describing Ferracute Rafter press brakes incorporating new features of design. 35

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INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Bulletin T-7, containing data on the properties and uses of Inconel, a corrosion-resisting nickel alloy. 36

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R. G. HASKINS CO., 617 S. California Ave., Chicago, Ill. Folder covering the Haskins line of rotary files, including the new ground-from-solid files. 37

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IDEAL COMMUTATOR DRESSER CO., Sycamore, Ill. Leaflet illustrating and describing electric markers and etchers for all types of material. 42

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ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Leaflet 2333, covering 2-3-4 adjustable single-groove combination sheaves. 44

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 285-304 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 285-304—or write directly to the manufacturer, mentioning machine as described in December MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76
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Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 280-281 mark with X in the squares below, the identifying number found at end of each description on pages 280-281—or write directly to the manufacturer, mentioning name of material as described in December MACHINERY.

201	202	203	204	205

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

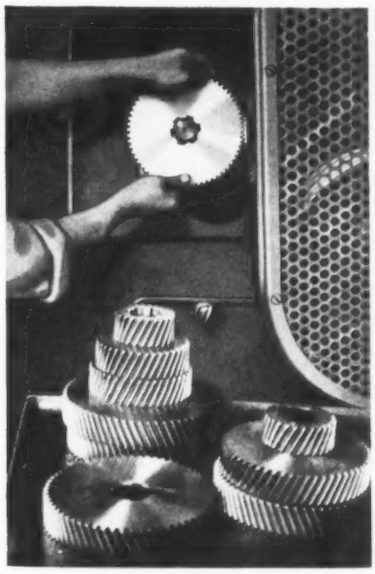


Fig. 2. Easily Accessible Change-gears on Acme-Gridley Automatic

Acme-Gridley Eight-Spindle Automatics

The eight-spindle automatics recently brought out by the National Acme Co., 170 E. 131st St., Cleveland, Ohio, have been designed to combine a high degree of precision with increased output where eight spindles can be used more efficiently than four or six spindles. These machines, designated as Model RA-8 Acme-Gridley multiple-spindle automatics, do not supersede the new RA-4 and RA-6 bar machines for work that can be handled as economically on the four- and six-spindle machines.

The new eight-spindle automatic, Fig. 1, is built in capacities for handling bar stock in sizes from 9/16 inch to 2 5/8 inches. The maximum length of the regular stock feed is 10 inches, and the turning length is 8 inches. The spindle speeds range from 101 to 1160 revolutions per minute. The machines are made for belt or motor drive, the motor-driven types being available with or without the motor. A 25-horsepower motor is used in the 2 1/4- and 2 5/8-inch machines.

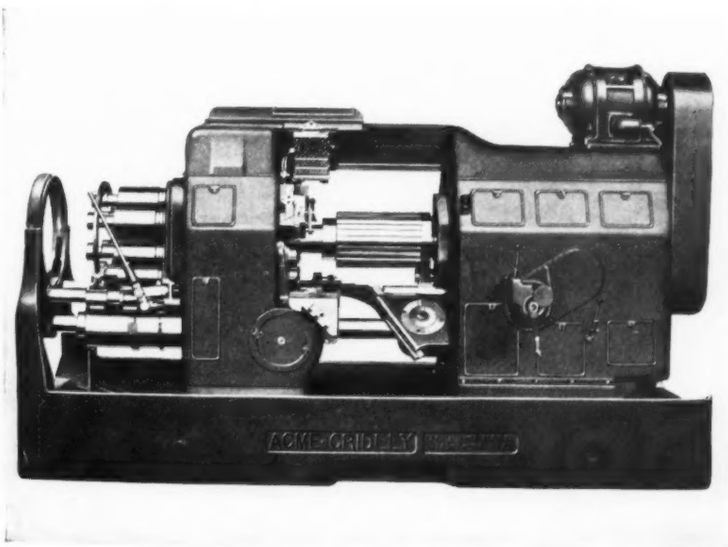


Fig. 1. Acme-Gridley Model RA-8 Automatic

The spindle-carrier and tool-slide design is the same as that of the four- and six-spindle automatics. The end tool-slide, Fig. 3, has a positive stop for accurate control of drills, reamers, and end-turning tools. There are six heavy-duty side-working tools, arranged as shown in Figs. 3 and 5. Each standard slide has an adjustable stop which affords fine control of forming sizes. The two lower side slides are set at an angle and are supported well back in the frame without overhang.

The two upper or top slides are mounted on the heavy top brace. Each slide is independently controlled from a horizontal drum in the top brace, and is driven through gears and a vertical shaft from the lower cross-

To obtain additional information on equipment described on this page, see lower part of page 284.

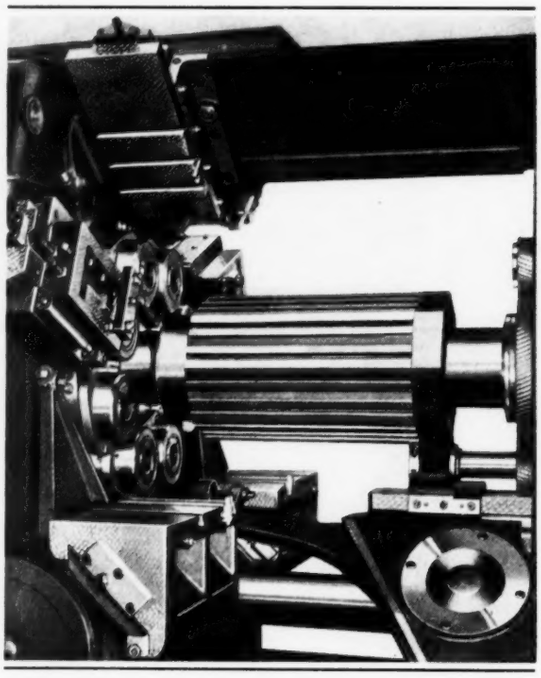


Fig. 3. Tool-slides and Spindle Ends on Acme-Gridley Automatic

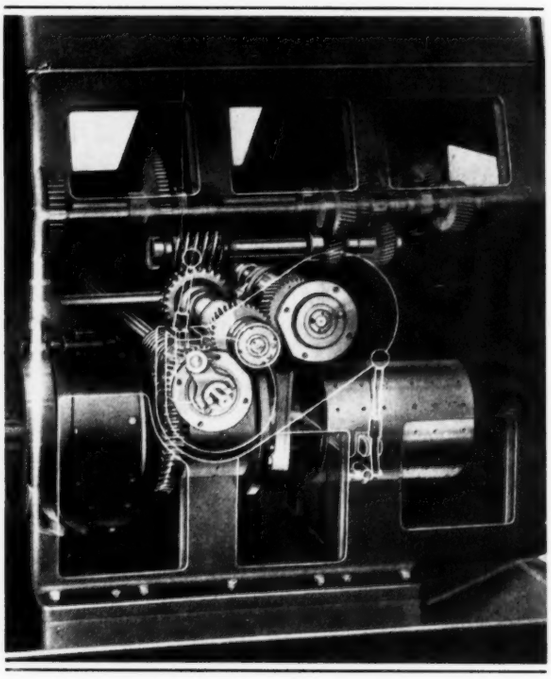


Fig. 4. Gear-box Section with Simplified Change-gear System

slide drum-shaft on the front side of the machine, as shown in Fig. 5.

Two centrally located side slides can be mounted on the face of the headstock housing adjacent to the third and sixth spindle positions. These intermediate slides are each independently controlled by vertically mounted cam-drums and are driven from the lower cross-slide drum-shaft on the front of the machine, as shown in Fig. 5. Such operations as finish-forming, form-turning, recessing, knurling, etc., can be performed by these slides.

A modified Geneva mechanism indexes the spindle-carrier, bringing it to a stop without shock before the positive locking pin is engaged. The hand chucking mechanism used in reloading the machine is protected by an automatic safety device which closes the chuck before the machine can be indexed. Cams for operating the chucking and feeding mechanism are conveniently arranged for quick changes on a drum located directly under the chucking slide.

The new stock-feed stop is rack-and-gear operated directly from the main drum-shaft. Its quick withdrawal after chucking to a rest position below the level of the side slides makes possible the use of tools in the stock-feeding position, gives access to the tools, and allows chips to drop freely into the pan.

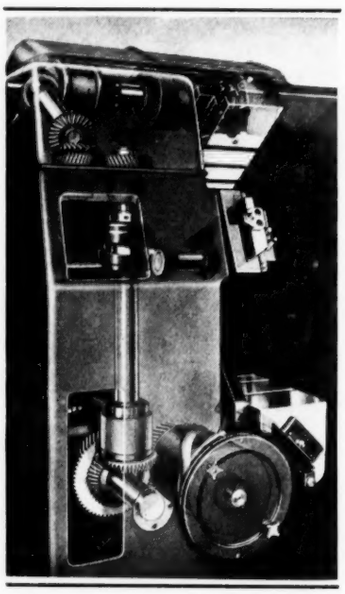


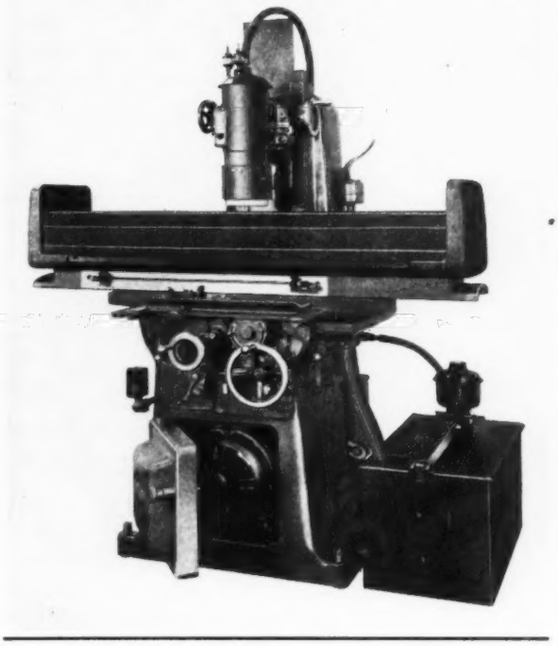
Fig. 5. Cam and Gear Arrangements for Driving Tool-slides

The gear-box section, Fig. 4, has a simplified change-gear system. A braking mechanism, combined with large disk and roller clutches, minimizes the non-productive time and safeguards the machine and tools. The gears of the interchangeable feed change-gear and spindle-speed change-gear system are all mounted at the motor end of the machine, and are quickly accessible, as shown in Fig. 2, by simply removing a cover.

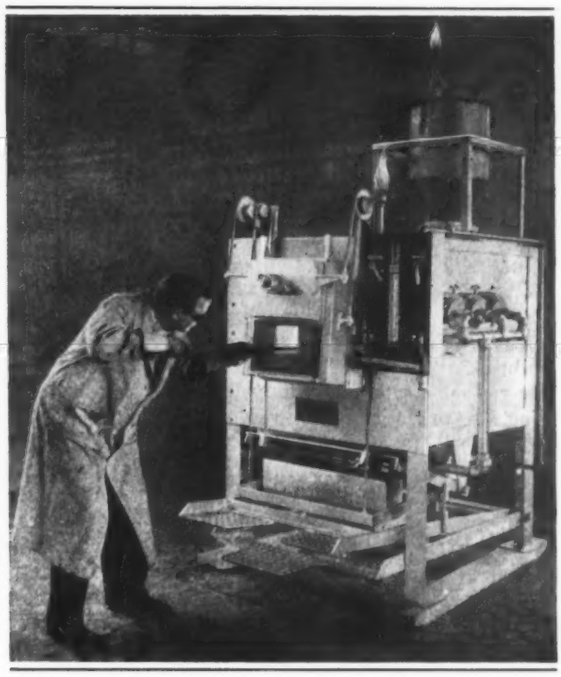
The use of a large variety of standard and special attachments is made possible by the increased number of working positions available in the eight-spindle design. All mechanisms are fully lubricated by a constant flow of filtered oil to every moving part. A direct-connected pump forces coolant oil from a reservoir in the pan to a large pipe in the top brace, from which flexible steel tubes or pipes carry coolant to each tool.

The arched spindle end of the machine permits easy installation of the standard chip conveyor, which is bolted to the rear end of the pan. A Chronolog records the causes of non-productive time. 51

To obtain additional information on equipment described on this page, see lower part of page 284.



Vertical-spindle Surface Grinder Built by the Abrasive Machine Tool Co.



Controlled-atmosphere Furnace Developed by the Surface Combustion Corporation

Vertical-Spindle Surface Grinder

The No. 34 vertical-spindle surface grinder recently added to the line of the Abrasive Machine Tool Co., Dexter Road, East Providence, R. I., is equipped with a heavy spindle driven by hardened and lapped spiral bevel gears. The spindle is mounted in ball bearings, and is carried in a wheel-slide which has square vertical ways in which wear is taken up by means of a taper gib.

The wheel-head is so arranged that it can be tilted or set straight where parts must be ground flat to close limits. The nose of the wheel-spindle is arranged to hold Type 2 plain cylinder grinding wheels, which are now furnished vulcanized to a thin steel plate. An adapter can be furnished for cup-wheels. The normal spindle speed for the standard 5-inch wheel is 3050 revolutions per minute. Table speeds of 20 and 40 feet per minute are provided, changes being made with a push-pull knob.

The table has an automatically controlled longitudinal movement of 24 inches and a hand-operated transverse movement of 8 inches. Vertical adjustment of the spindle, with automatic control, is 12 inches. The vertical feed can be adjusted to advance from 0.000125 to 0.0002 inch at each table reversal. The dial can be set to a predetermined depth of cut, and will automatically throw out the feed at the desired point, or it can be locked for continuous feeding. The handwheel for fine adjustment of the vertical spindle is provided with a dial graduated to 0.00025 inch. Standard equipment includes table guards, portable tank, and motor-driven centrifugal pump for use in wet grinding.

The working surface of the table is 8 by 24 inches. The machine weighs approximately 3000 pounds, and requires a floor space of 48 by 100 inches. 52

Char-Mo Furnace for Treating Alloy Steels

A new type of controlled-atmosphere furnace, known as the Char-Mo, for treating molybdenum alloy and other steels—both high-speed and carbon—without decarburization was exhibited at the recent National Metal Show in Detroit by the Surface Combustion Corporation, Toledo, Ohio.

The controlled atmosphere used in this furnace was developed especially for treating molybdenum high-speed steel without a protective coating. It is said, however, that the atmosphere is ideal for treating all types of steels, such as are used in the manufacture of tools, dies, and parts subjected to wear, which require a non-oxidizing and non-decarburizing atmosphere for heat-treatment. The Char-Mo atmosphere is produced from a carbonaceous material, such as charcoal. Essentially, it consists of a mixture of balanced carbon oxides diluted with inert nitrogen.

This furnace is being built in two types—a horizontal muffle type and a vertical muffle type—and in temperature ranges of 1400 to 1850 degrees F. and of 2000 to 2400 degrees F. A variety of muffle sizes are available in both types. 53

To obtain additional information on equipment described on this page, see lower part of page 284.

H-P-M Injection Molding Press

A molding press with a capacity of 32 ounces of plastic material per "shot" has been introduced on the market by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, under the designation Model 500 Hydro-Power injection molding press. This press is of the vertical downward-acting mold clamp type, following in design the basic principles of the Model 100, previously described in MACHINERY. In the new press, two 8-ounce capacity injection units are mounted on each side, thus giving the press a total of 32 ounces injection capacity per "shot."

The power unit for operating the clamp is mounted overhead on the back of the frame. The surge tank containing the operating oil is mounted overhead. Auxiliary reservoirs connected with the surge tank are provided under each injection unit. Separate power units for each injection unit are mounted on these auxiliary reservoirs just back of the injection cylinder supports. A hydraulic ejector is built into the clamp base.

The Fastraverse system of operation employed in this new press is the same as has been used for more than ten years on the company's Fastraverse presses developed for the metal-working industry. Thus, while the Model 500 injection molding press is new in design, the basic principle behind it has been thoroughly proved in practice. 54

Hanna Electric-Hydraulic Riveting Press

The 60-ton electric-hydraulic riveting press and fixture here illustrated have been brought out by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., for use in riveting automobile right- and left-hand front-wheel control-arm assemblies. This operation involves multiple riveting at the rate of forty-five rivets per minute.

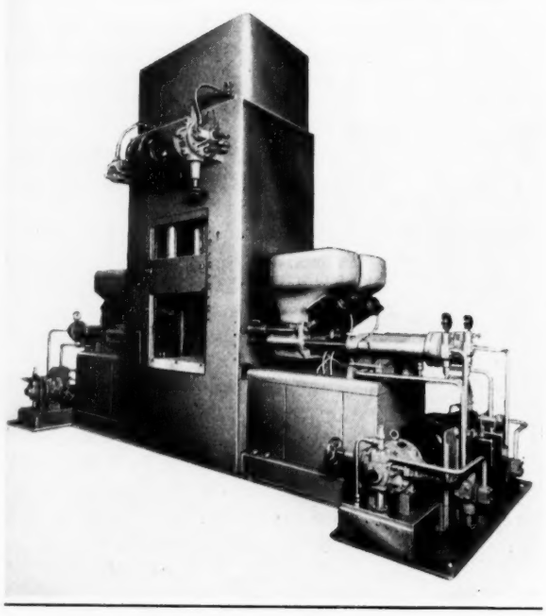
After depressing a duplex control lever, the entire cycle of clamping the parts, riveting, and returning the ram to its starting position is automatic. The control arrangement has two important safety features; releasing the lever instantly reverses the pressure stroke, and also prevents the cycle of operations from being repeated.

Maximum pressure can be regulated to suit the work; thus the power consumption is held to a minimum and distortion of the work through excess pressure is avoided. The riveter shown exerts a pressure of 60 tons on the dies at the maximum fluid pressure. It is also available in capacities of 20, 40, and 80 tons. The "reach" or gap can be varied to suit the work. 55

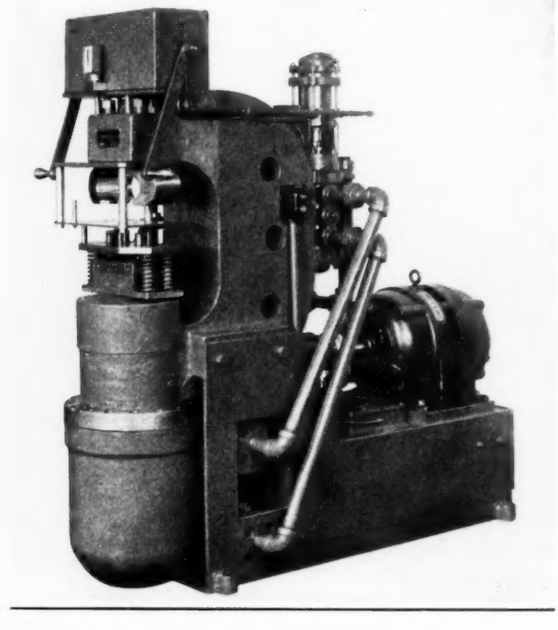
Simmons 36-Foot Floor Type Boring Mill

A floor type boring mill with a capacity for turning work 36 feet in diameter, for boring work 28 feet in diameter, and for facing internal and external diameters of these dimensions has recently been built by the Simmons Machine Tool Corporation, North Broadway, Albany, N. Y., for a firm handling heavy shipyard work.

This boring mill is especially intended for machining large gears or rings for revolving mechanisms used in trunnions and transmissions. The maxi-

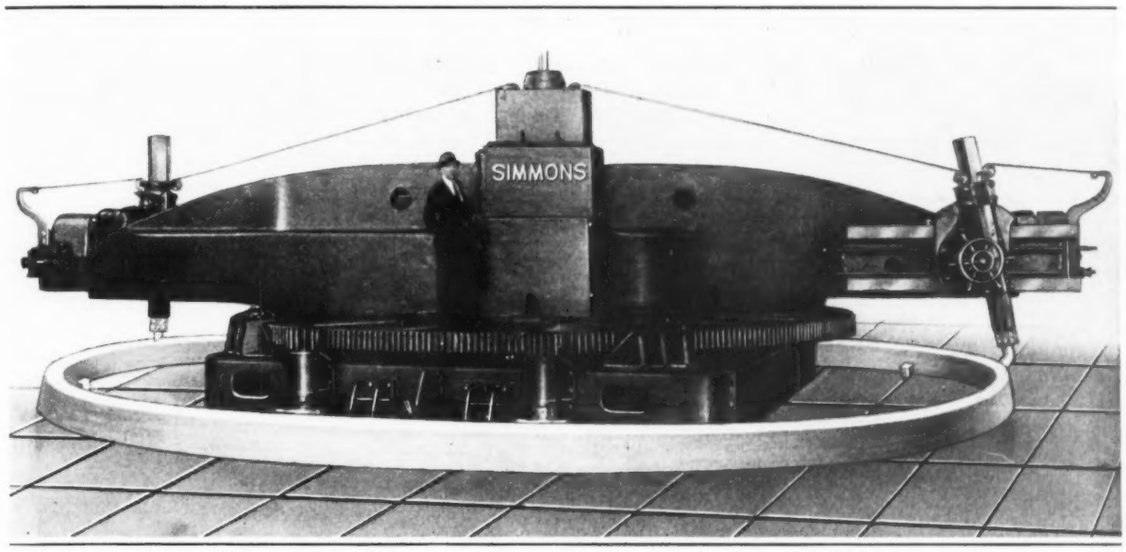


H.P.M. Model 500 Injection Molding Press



Hanna 60-ton Electric-Hydraulic Riveting Press

To obtain additional information on equipment described on this page, see lower part of page 284.



Simmons Boring Mill with Capacity for Turning Work 36 Feet in Diameter

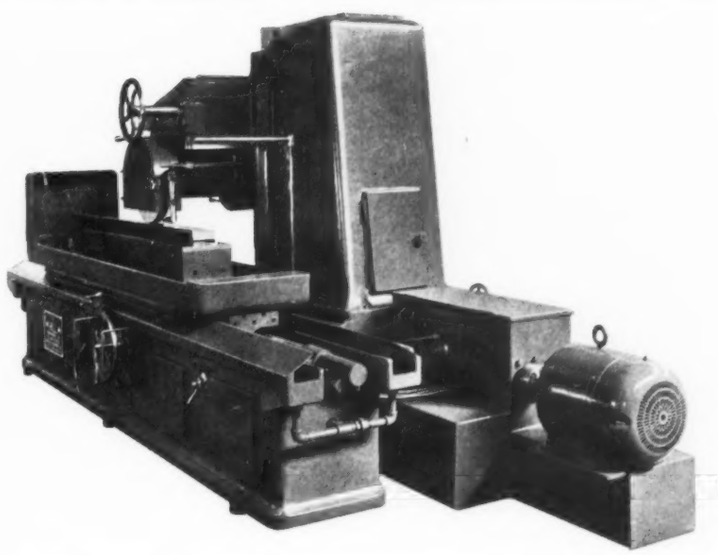
mum height of work that can be machined is 48 inches. Each head can be swiveled for taper boring or facing. Push-button control is provided for each head, and there are independent power feeds for the boring-bar of each head. 56

Hill Hydraulic Precision Surface Grinder

The Hill Clutch Machine & Foundry Co., 6400 Breakwater Ave., Cleveland, Ohio, has recently added a horizontal hydraulic grinder to its line of precision surface grinding machines. Standard size wheels up to 6 inches wide are used in the new machine, the grinding being done by the periphery of the wheel. The wheel-spindle is driven by a dynamically balanced built-in motor. Rapid traverse is provided for raising and lowering the wheel-head, and there is a hand control for final adjustment. The table and cross-feed are hydraulically operated.

Forced-feed lubrication is provided for the table ways and spindle bearings. There is a large coolant supply tank equipped with a motor-driven pump. Various types of magnetic chucks can be furnished. This machine is adapted for grinding flat or irregular surfaces, either on production or special work, including the grinding of machine tool beds and tables, hardened steel ways, die-blocks, forgings, machine knives, stamping dies, pump bodies, locomotive guide bars, etc.

It is built in sizes having working table surfaces from 18 to 24 inches wide and from 5 to 20 feet long. The motor-driven pump supplies oil under pressure to two opposing cylinders, providing table speeds that are instantly variable up to 100 feet per minute. The cross-feed can be oscillated at a constant feed or adjusted from 1/8 inch to 2 inches at each reversal of the table for a "jump" feed. The machine is equipped with five motors, ranging from 1/4 horsepower for driving the lubricating pump up to 15 to 40 horsepower for driving the main spindle. ..57



Surface Grinder with Magnetic Chuck for Grinding Shear Knives

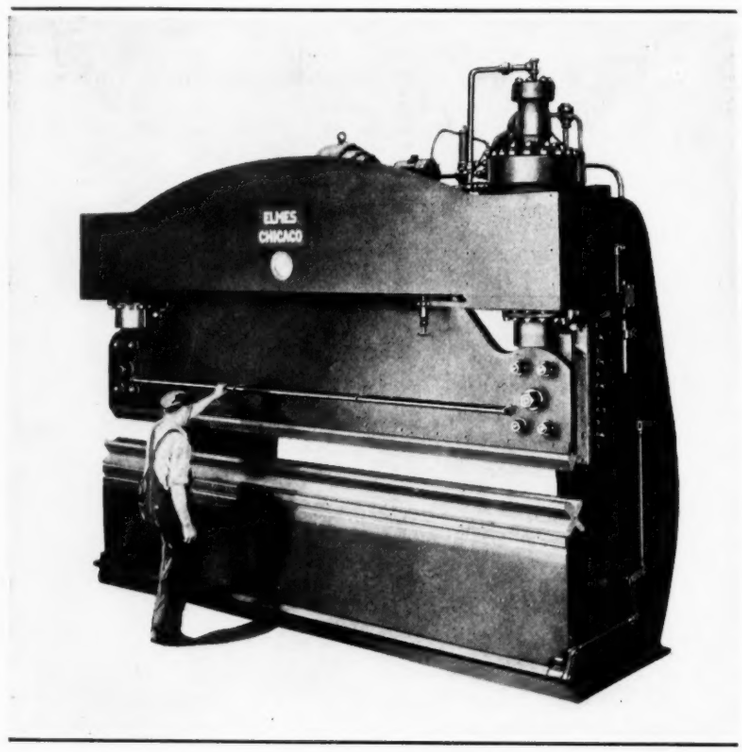
To obtain additional information on equipment described on this page, see lower part of page 284.

Elmes Hydraulic Bending Brake

A hydraulic bending brake for bending and forming sheet metal has been introduced on the market by the Charles F. Elmes Engineering Works, 222 N. Morgan St., Chicago, Ill. Economy of operation, simplicity, faster production, and greater safety are among the advantages claimed for this equipment.

It is impossible to damage this machine by attempting to handle work beyond its capacity, for if the maximum rated capacity is exceeded, an automatic valve will open, allowing the excess oil to be returned to the reservoir. Varying thicknesses of material can be handled without making stroke adjustments, since the bending beam continues its downward motion as long as the foot-pedal is depressed. Releasing the foot-pedal immediately reverses the movement of the bending beam.

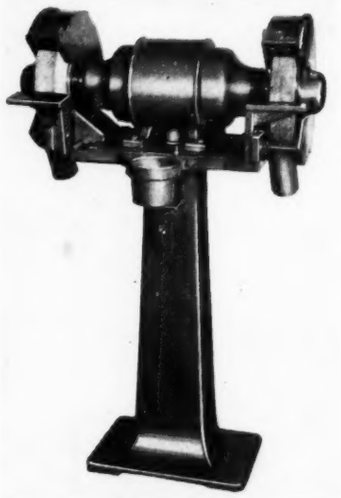
The bending beam approaches the work at a rapid advance speed and automatically slows down for the actual bending or forming operation, in this way giving the operator a chance to check the location of the piece and angle of the bend. Movement of the bending beam can be stopped and held to any predetermined point by the operator while he checks the work. The return movement of the bending beam is at a fast rate. Pressure lubrication is employed to assure a minimum amount of wear on the guides. With the exception of the guides, no other lubrication is required, since the hydraulic pump is of the self-lubricating type. 58



Elmes Hydraulic Bending Brake for Forming and Bending Sheet Metal

Cadet Pedestal Grinder

The Cadet 12-inch ball-bearing pedestal grinder here illustrated was developed by the Standard Electrical Tool Co., 1938-46 W. Eighth St., Cincinnati, Ohio. This machine will accommodate grinding wheels up to 12 inches in diameter having a face width of 2 inches.



Cadet Pedestal Grinder Made by the Standard Electrical Tool Co.

The wheel guards are of the safety type, being enclosed and adjustable to compensate for wheel wear. Each guard has an exhaust outlet, an adjustable spark-breaker, and a tool-rest. This grinder is available for operation on alternating current only. 59

Yale "Cable King" Electric Hoist

A wire-rope electric hoist known as the "Cable King" has been brought out by the Yale & Towne Mfg. Co., Philadelphia Division, Philadelphia, Pa., in capacities ranging from 1/4 ton to 6 tons, with lifting heights from 15 to 45 feet. The hoisting and lowering speeds range from 14 to 72 feet per minute.

An important feature of this hoist is the low-pressure air circulating and cooling system developed to eliminate excessive heating of the brake-drum. This system is provided with cooling fins cast in the brake-drum in the line of the air stream. As the load is lowered, the fins revolve, forcing a constant flow of cool air around the brake and gear housing. Vents are provided in the bottom of the housing to permit the air to circulate freely. 60

To obtain additional information on equipment described on this page, see lower part of page 284.

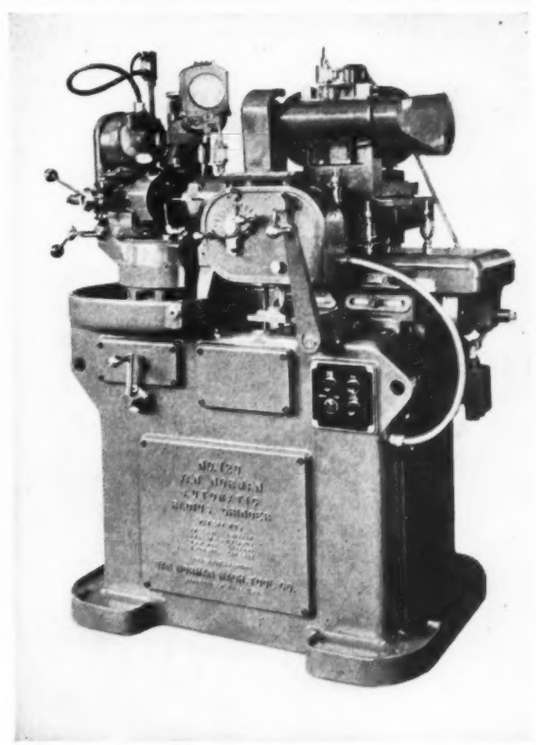
Van Norman Automatic Internal Radius Grinder

The Van Norman Machine Tool Co., Springfield, Mass., has recently brought out a new Model 120 radius grinder designed particularly for grinding the raceways of the smallest ball-bearing outer rings up to the 204 size, which have a diameter of approximately 1 7/8 inches. This machine is adapted for use in the aviation, instrument, electrical, and automotive fields, or wherever small diameters must be ground.

Engineering features developed by this company in making oscillating radius grinders during the last twenty years have been incorporated in this new machine. The company's three-point contact ball-bearing is used to insure a high degree of rigidity in the oscillating head. A crank drive provides a positive smooth movement of the oscillating units. All slide movements are supplied by simple mechanical means.

The race to be ground is loaded into the fixture and the machine started by a finger-operated lever which automatically moves the wheel into the grinding position and retracts the wheel to compensate for stock removal. The work-head automatically starts rotating and oscillating, and the wheel feeds into the work. When the race is ground to size, the wheel automatically moves to the unloading position and the work-head stops. The complete grinding cycle is controlled by simple electrical equipment.

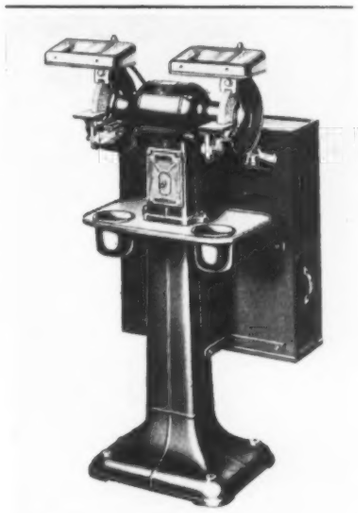
Since electric gaging is not satisfactory for very small sizes, this machine has, in addition to the electrical gaging equipment, an electric control on the feed-drum, so that when the wheel is fed to the proper size, the slide will automatically move to the unloading position. A motorized work-head provides a spindle speed of 2000 revolutions per minute. The wheel-spindle operates at speeds up to 40,000 revolutions per minute and is driven by a three-horsepower motor belted to a ball-bearing jack-shaft which, in turn, is connected by a belt to the wheel-spindle. The drive unit is mounted directly on the wheel-slide. Changes in wheel-spindle speed are obtained by changing pulleys on the spindle drive unit. 61



Van Norman Radius Grinder, Designed for Grinding the Raceways of Small Ball Bearings

Delta Self-Contained Dust-Removal Cabinet

The Delta Mfg. Co., 609 E. Vienna Ave., Milwaukee, Wis., has developed a self-contained dust-removal cabinet which can be attached to any pedestal grinder of the company's manufacture. The cabinet contains dust filters which trap practically all the fine dust carried down the discharge chutes of the grinder. It is also fitted with baffles which discharge the heavy particles into the cabinet base, from which the dust can be easily removed.



Delta Pedestal Grinder Equipped with Dust-removal Cabinet

The unit requires no power; and since it is completely self-contained, the grinder to which it is fitted can be used anywhere in the shop. 62

"Wood" Flexible Coupling

A line of flexible couplings made in sizes to fit shafts from 1/4 inch to 1 1/4 inches in diameter and in capacities ranging from 1/4 to 7 1/2 horsepower at speeds of 1800 revolutions per minute has been placed on the market by the Shallcross Co., 48th and Grays Ferry Road, Philadelphia, Pa. These couplings, known by the name "Wood," have been designed to operate quietly and without heating. They will operate efficiently with parallel or lateral shaft displacements up to

To obtain additional information on equipment described on this page, see lower part of page 284.

0.0625 inch and with an angular displacement of at least 10 degrees.

The "Wood" couplings are obtainable in various types, with hardened steel, canvas, Bakelite, and rubber replaceable load-cushions. Complete electrical insulation is provided for all styles and sizes. End thrust of the motor or driven part is provided for by the coupling. Silent operation is obtained through insulation of the center member. All types of these couplings are reversible. 63

Rafter Steel Press Brake

The Rafter steel press brake, for which manufacturing rights have been acquired by the Ferracute Machine Co., Bridgeton, N. J., is being marketed by the Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill., which has exclusive selling rights for this product. This steel press brake is of a new patented design in which the ram is pulled downward into the work, power being applied from below the dies.

A quick-releasing safety overload device is incorporated in the clutch and engages automatically when the clutch is reversed, instantly backing the ram and releasing the work without damaging the dies. A clamp built into the ram for holding the upper die will hold straight-shank, L-shank, or T-shank dies. The lower die-holder is provided with a key that fits a groove in the bed to insure accurate die alignment.

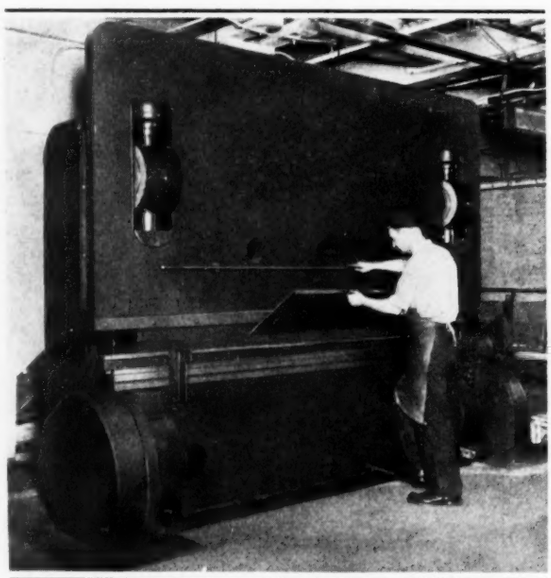
These press brakes are regularly made in nine sizes, covering a capacity range for forming mild steel from 6 feet by 1/4 inch over a die width of 2 inches up to 12 feet by 5/16 inch over a die width of 2 1/2 inches, including mild steel 8 feet by 1/2 inch over a die width of 4 inches. The die widths are from 1 1/4 up to 4 inches. The clear widths between housings are from 6 feet 6 inches up to 12 feet 6 inches. The motors required to operate these machines range from 7 1/2 to 15 horsepower. 64

Acme High-Speed Six-Spindle Semi-Automatic Coupling Tapper

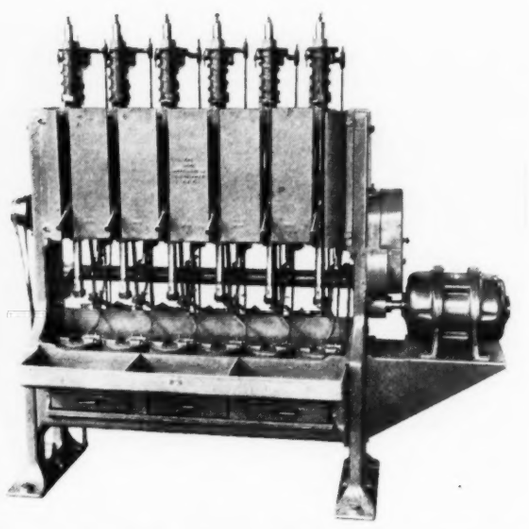
A six-spindle semi-automatic coupling tapper with automatically air-operated chucks has just been introduced on the market by the Acme Machinery Co., 4535 St. Clair Ave., Cleveland, Ohio. This machine will tap 3/4-inch couplings at the rate of 1250 per hour. The scroll air chucks with which each spindle is provided are automatically closed and opened with the downward movement of the spindles.

The coupling to be tapped is placed in the chuck and the operator trips a lever at the right of the spindle. The spindle then completes its cycle, the chuck being closed, the coupling tapped, and the chuck opened again, allowing the spindle to return to its starting position through power-actuated cams, with the coupling on the tapped shank. Provision is made for cushioning the spindles on the downward stroke.

The production of these machines has been greatly increased by the use of the quick-acting automatically operated air chucks which, together with the power-actuated vertical movements of the spindles, also eliminates all heavy manual operations, thus lessening operator fatigue. The



Rafter Steel Press Brake Marketed by Bryant Machinery & Engineering Co.



Acme Six-spindle Semi-automatic Tapper with Air-operated Chucks

To obtain additional information on equipment described on this page, see lower part of page 284.

new machines have a work capacity range for 1/8- to 1 1/4-inch standard pipe couplings, and are motor-driven. Machines are also built in capacities for handling couplings up to 7 inches. 65

Hammond Automatic Polishing and Buffing Machine

The Hammond Machinery Builders, Kalamazoo, Mich., have added a new model to their line of automatic polishing and buffing equipment, designated the Type J, Model SH. This new machine is designed to handle a wider range of work than the present J models and to carry motors up to 7 1/2 horsepower. Although designed primarily for polishing and buffing "rounds" up to 6 5/8 inches in diameter when held by mechanical fixtures, and "flats" up to 3 by 6 inches held by magnetic chucks, "rounds" as large as 10 5/8 inches in diameter, as well as odd-shaped "flats," can be handled.

In the illustration the heads of the machine are shown with the wheels mounted on extended shafts. With this arrangement, the spindle speed is limited to the motor speed which, on alternating-current 60-cycle service, is either 1750 or 3500 revolutions per minute. This machine, however, can be obtained with multi V-belt driven heads to provide any spindle speed required.

The table is rotated by a Geneva movement, and has eight revolving spindles which are connected by chain sprocket drives to a ball-bearing worm reduction unit. For loading and unloading, however, the three spindles at the operator's station cease revolving. The table is driven by a 1/2-horsepower motor with a V-belt drive having variable-pitch sheaves that facilitate changing the table indexing speeds. Production up to 1800 pieces per hour is possible, depending on the nature of the work. 66

General Electric Direct- and Alternating-Current Welders

A new 150-ampere direct-current single-operator arc welder adapted for light-gage work has been developed by the General Electric Co., Schenectady, N. Y. This equipment, which is illustrated in Fig. 1, is designed to prevent arc "pop-outs" at all points in its wide welding range when using any bare, lightly coated, or heavily coated electrode. Isothermic overload protection permits the equipment to carry maximum safe overloads without danger of burnouts and without unnecessary interruptions. The equipment is rated at 150 amperes at 25 volts, and its range of adjustment varies from 20 to 200 amperes at 25 volts.

The new 150-ampere alternating-current arc welder of the transformer type recently brought out by the same company for low-current welding with heavily coated alternating-current arc-welding electrodes is intended primarily for use on light-gage metals. The wide welding range—35 to 180 amperes—permits this welder to be used on fairly heavy materials. This new equipment, which is illustrated in Fig. 2, has the woven, spun-glass, fireproof insulation which prevents damage from heat on heavy overloads. Continuous stepless current control is obtainable by means of a hand-crank to suit fine work. A choice of two open-circuit voltages—80 and 100 volts—is pro-

Hammond Eight-spindle Automatic Polishing and Buffing Machine

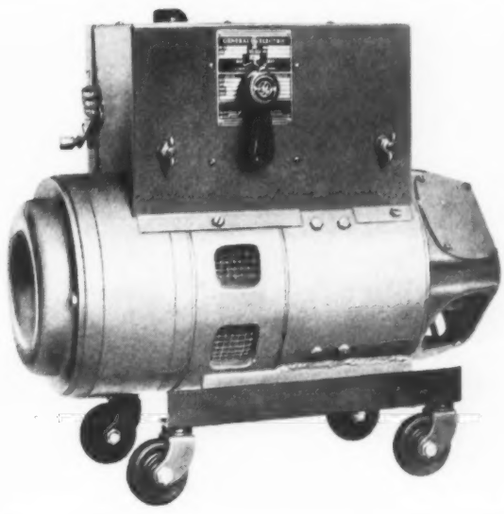


Fig. 1. General Electric Direct-current Portable Motor-generator Arc Welder

To obtain additional information on equipment described on this page, see lower part of page 284.

Fig. 2. General Electric Alternating-current Arc Welder

vided to handle all types of alternating-current electrodes. Portability is provided by casters or by means of a hoist sling over the hand-crank. 67

Small-Sized Ball Bearings

The Split Ballbearing Corporation, Lebanon, N. H., has recently brought out an unusual line of miniature-sized precision radial ball bearings as an addition to the company's standard ball, roller, and thrust bearings of the divisible type. The new series ranges from 5/16 inch in diameter down to 1/8 inch. These tiny bearings are exact replicas of regular deep-groove, full radial type, high-capacity bearings with filling slots.

Owing to their capacity for relatively heavy loads, these bearings can be used in applications where jewel pivots cannot be employed because they lack the required strength. They are suitable for many instruments in which precision must be maintained in spite of rough handling or shocks. Since the bearings have a large thrust capacity, they find application where thrust is encountered. They have been employed for the mountings of a heavy compass forming part of an oil survey instrument, and also for parts of the mechanism of a moving picture camera intended for Polar expedition use. They are particularly suitable for this purpose, since they will operate without lubrication and thus avoid the difficulties experienced with oil at very low temperatures. 68

Brown & Sharpe Centrifugal Motor-pump

Brown & Sharpe Centrifugal Pump

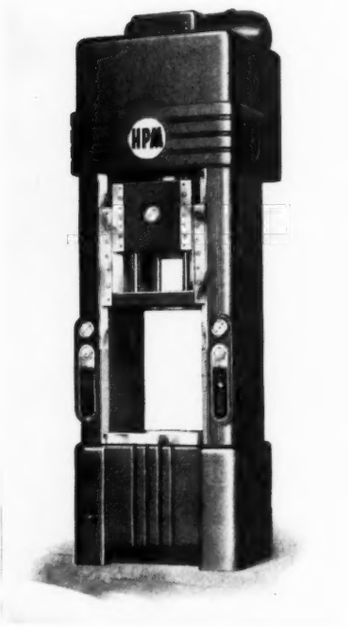
The Brown & Sharpe Mfg. Co., Providence, R. I., has recently added to its line a No. 212 centrifugal motor-pump, which is particularly suited for supplying coolant to machine tools and light machinery, as well as for other installations where a large volume is required at a low head and where dirt or abrasive may be present in the liquid.

The pump is designed to be mounted in a tank with a maximum depth of submergence indicated by the water line. The discharge pipe clears the motor—a convenience in piping and installation. The pump is fitted with a fully enclosed motor and grease-sealed ball bearings. To protect the motor, provision is made in the design to prevent the liquid in the shaft housing from rising above the level of the supply. 69

Hydro-Power Fastraverse Presses

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has developed a new series of Hydro-Power Fastraverse presses known as the "Smooth Line," because of the streamline effect introduced in the design. These presses are self-contained, with an operating unit including a Model 4R radial pump driven by an electric motor mounted overhead and totally enclosed. All piping and control mechanism are concealed, although every operating element is easily accessible for adjustment and maintenance.

The H-P-M Fastraverse system of operation is incorporated in the new presses, which gives rapid approach of the ram to the work, a slower pressing speed to permit the metal to flow into the contours of the die, and a speedy return of the ram to its initial position. 70



"Smooth Line" Fastraverse Press Built by Hydraulic Press Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 284.

Gilman "Four-in-One" Tool-Room Machine

The Gilman Engineering Works, 214 N. First St., Janesville, Wis., is placing on the market a "four-in-one" tool-room machine which combines a precision lathe, horizontal miller, vertical miller, and drill press. The precision lathe has a 9-inch swing and a distance of 12 inches between centers, with a 24-inch bed. The tailstock is adjustable to take up wear, and there is a device for clamping the compound rest at any position on the lathe bed.

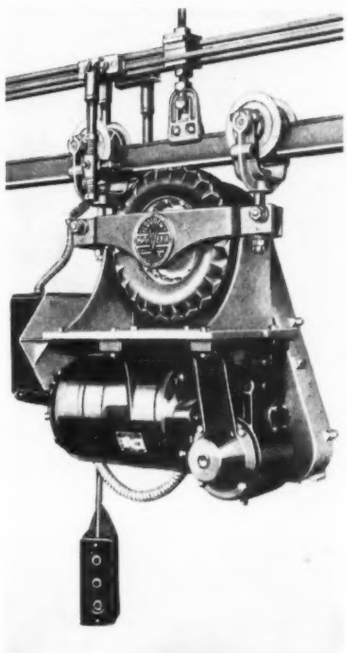
The horizontal miller has a 4- by 18-inch table, and a 10-inch travel. The horizontal miller and lathe are driven by a reversible one-horsepower motor mounted inside the base. There are eight spindle speeds ranging from 80 to 2500 revolutions per minute. The quill of the vertical miller can be raised or lowered 4 inches.

The drill press is available by turning the vertical milling head 90 degrees over an 8 1/2-inch table, which gives a space of 7 1/2 inches between the table and spindle. The drill press and vertical miller are driven by a 1/2-horsepower reversible motor which provides spindle speeds from 390 to 2200 revolutions per minute. Illumination of the work is furnished by "Vimcolighting." The weight is 1000 pounds.....71

Four-in-one Machine for Milling, Drilling and Lathe Work

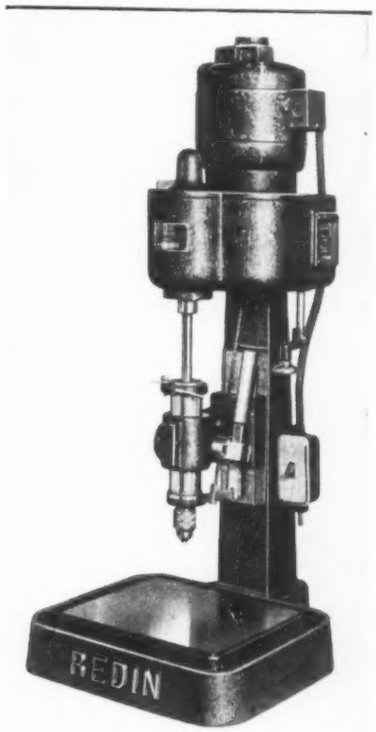
Louden "MotoVeyor"

The "MotoVeyor" recently developed by the Louden Machinery Co., Fairfield, Iowa, is a power-operated machine for automatically transporting loads over an overhead track system. It will travel up inclines and maintains uniform speed going down grade. The speed range is from 60 to 600 feet per minute, the movement being smooth and steady.



"MotoVeyor" for Transporting Loads over an Overhead Track

This equipment can be built into a cab or step-on platform conveyor, so that the operator can accompany the loads if desired, and it can also be used in power-driven cranes. The simplicity and efficiency of this equipment are said to be due to the fact that a rubber tire is utilized for the drive-wheel. The drive-shaft is supported in ball bearings. 72



Redin Drilling Machine with "Rolling Wedge" Transmission

Redin Sensitive Drilling Machine

A sensitive drilling machine with a capacity for drilling holes up to 5/16 inch in diameter has been brought out by the Crescent Mfg. Co., 1104 Tenth St., Rockford, Ill. This machine is intended both for high-speed production work and tool-room requirements. It is provided with the so-called "rolling wedge" four-speed transmission which is said to be as powerful as a gear drive and yet smoother running than a belt drive. By its use, the pressure is automatically adjusted to the resistance of the work being done, and wear is practically eliminated, since power is transmitted by rolling contact and not by friction drive. Speed changes can be made while the motor is idle or running. The machine is provided with New Departure grease-sealed ball bearings.

The spindle travel is 3 3/8 inches, the distance from the spindle to the column, 6 1/2

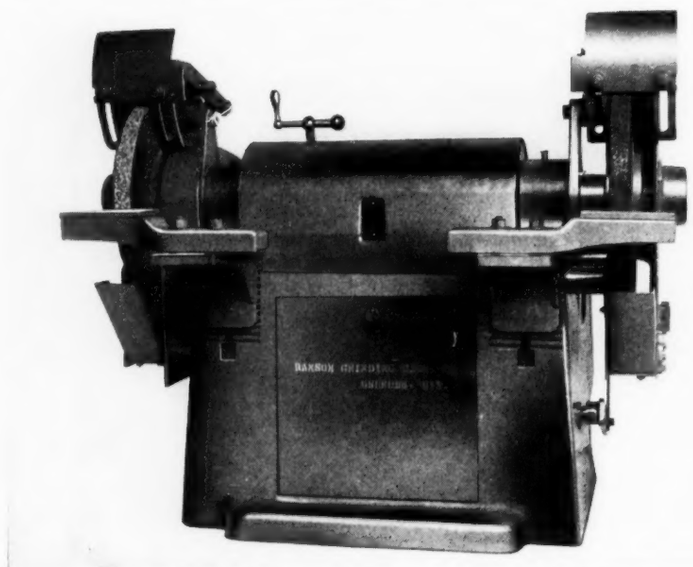
To obtain additional information on equipment described on this page, see lower part of page 284.

inches, and the size of the table, 10 by 12 inches. The motor is 1/2 horsepower, running at 1725 revolutions per minute, and the spindle speeds are 900, 1800, 3300, and 5000 revolutions per minute. The over-all height of the machine is 38 inches. 73

Ransom Constant Peripheral-Speed Grinders

A Type D grinder designed to drive 24-inch vitrified wheels at a constant peripheral speed of 6400 feet per minute until the wheels are worn down to a diameter of 10 or 11 inches has been brought out by the Ransom Grinding Machine Co., Oshkosh, Wis. This machine is driven by a 5-horsepower or a 7 1/2-horsepower totally enclosed fan-cooled ball-bearing motor, using any suitable direct or alternating current. Guards made of plate steel are provided which meet all safety codes and state safety requirements. The machines have hinged doors, nut covers, and spark arresters that are adjustable for wear of the wheel. The exhaust pipe connections are so arranged that only dust enters the exhaust pipes and solid material drops into the bottom of the guard, where it can easily be removed. The rests are adjustable in all directions and have steel-lined surfaces which can be renewed when worn.

Speed control is accomplished by turning the handwheel at the top of the machine. This brings the levers shown in the upper inside part of each wheel guard into contact with the lug on the spark arrester, which automatically regulates the speed-changer unit to give the proper speed for the diameter of the wheel at the time the adjustment is made. This adjustment can be made while the machine is running. When the lever touches the lug on the spark arrester, the handwheel cannot be turned further, thus preventing any possibility of obtaining a speed above 6400 surface feet per minute. 74



Ransom Grinder Designed to Maintain Constant Peripheral Speed of Wheel

Portable Hoist Operated from Lamp Socket

A portable plug-in electric hoist of heavy-duty construction known as the "Comet" has been developed by the Chisholm-Moore Hoist Corporation, 122 Fremont Ave., Tonawanda, N. Y. This hoist can be easily carried and installed by one man. It is operated by a specially built heavy-duty high-torque motor that runs on an ordinary light circuit or three-phase power line.

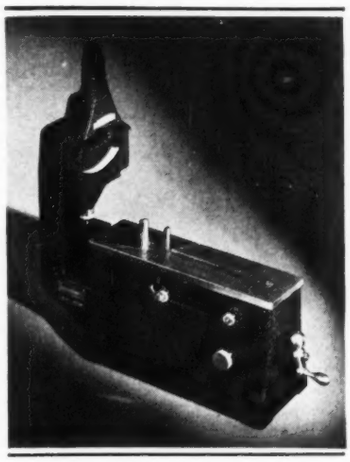
Comet Portable Plug-in Electric Hoist Made by the Chisholm-Moore Hoist Corporation

The compact design and ease of operation make this hoist especially useful for service on production lines in large plants. A controller with a patented "delayed reversing" feature, which can be operated easily with one hand, affords an extremely sensitive control for lifting the load a fraction of an inch or more as desired. The quick-acting positive brake is designed to prevent the load from drifting. This hoist is made in four capacities, namely, 250, 500, 750, and 1000 pounds, and in several speeds. The 500-pound size weighs only 85 pounds. 75

Sheffield Universal Internal Measuring Machine

The Sheffield Gage Corporation, Dayton, Ohio, has recently brought out a universal internal measuring machine that provides an infinite range in the measurement of any size internal diameter within the capacity of the machine. The standard Model N-2 machine measures all in-

To obtain additional information on equipment described on this page, see lower part of page 284.



Sheffield Universal Measuring Machine for Checking Internal Dimensions

ternal dimensions from 5/8 inch up to 6 inches against a precision block setting. Models with other size ranges are available.

Two fingers, each carrying a measuring point and both adjacent to a vertically traveling work-rest plate permit full exploration and determination of the dimensions of a hole on any point of its internal surface within the 1 1/2-inch depth range of the gage.

Each of the gaging elements of the machine is mounted on vertical reeds to eliminate loss of accuracy through friction. The so-called "fixed" gaging point floats on vertical reeds with a fixed relation to the reed pivot that transfers the motion of the adjustable gaging point to the visual gage. Therefore, only a variation in the distance between the two gaging elements will change the visual gage-reading. A gaging pressure only is exerted on the sides of the hole being checked, irrespective of the operator's touch on the part being measured. 76

Springfield Ball-Bearing Geared-Head Tool-Room Lathe

A tool-room lathe with a ball-bearing geared head having twelve changes of speed and a spindle equipped with taper roller bearings has been brought out by the Springfield Machine Tool Co., Southern Ave. and P. C. C. & St. L. Ry., Springfield, Ohio. The outstanding feature of this lathe is its complete

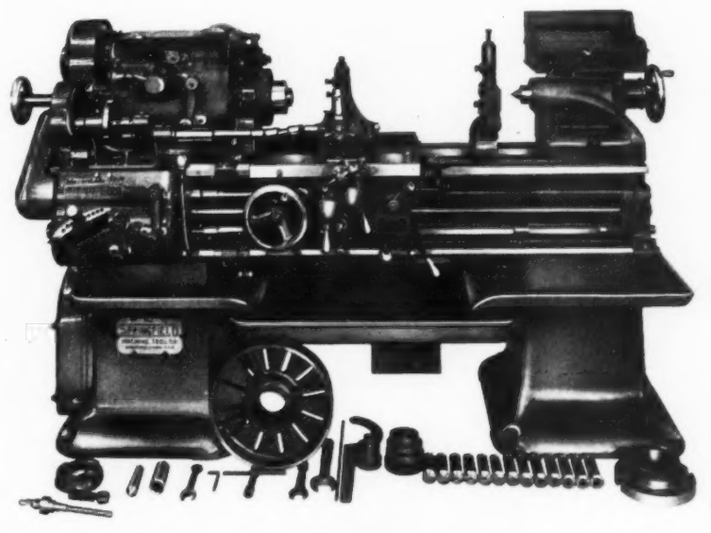


Fig. 1. Springfield Tool-room Lathe Built to Produce Work to Metric Measurements

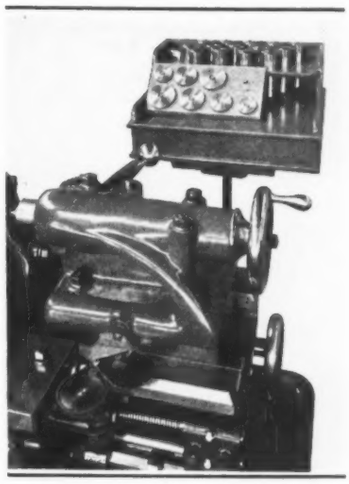


Fig. 2. Dial that Indicates Proper Time to Engage Half-nuts for Producing Metric Threads

metric system. The lead-screw and all the measuring screws are manufactured to produce work to metric measurements. The machine has full tool-room equipment, including a relieving attachment, taper attachment, draw-in collet attachment, and oil pan.

The unique thread-chasing dial, shown in Fig. 2, indicates the proper time to insert or engage the half-nuts for producing any of the metric threads listed on a chart furnished with the machine. There is a dial for each column of threads indicated on the index-plate and full instructions are given on a data sheet for using each dial and inserting it. The dial mechanism can be dropped out of engagement when not in use. With this equipment, threads having leads from 0.2 to 18 millimeters can be cut. 77

Mico Engraving Machine

Large panels requiring engraving at various locations on their surfaces can be engraved by means of a "Base B" engraver brought out by the Mico Instrument Co., 10 Arrow St., Cambridge, Mass. This engraver can be set on the panel and the necessary engraving performed by a simple operation. A standard three-line copy carrier is used, so that twenty-five to twenty-

To obtain additional information on equipment described on this page, see lower part of page 284.

seven characters of standard size type can be assembled in each line. The assembled machine is heavy enough to stay in position while the engraving operation is being performed.

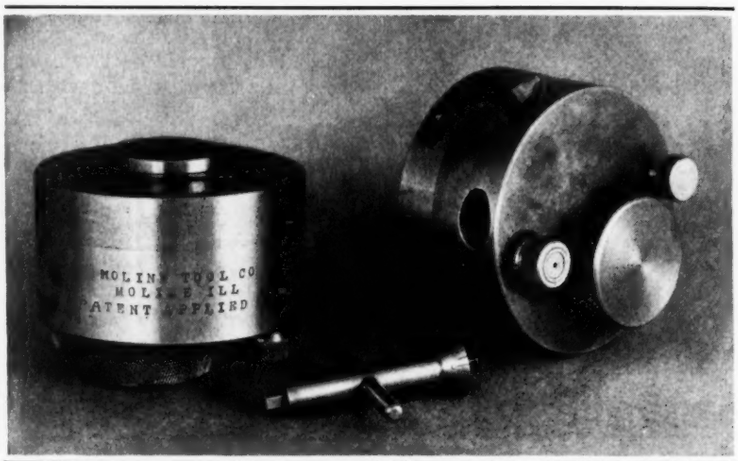
The Base B engraver is furnished as an accessory for use interchangeably with the company's Base A equipment, or it can be furnished with a pantograph and copy carrier. The constant-depth device for the Base B engraver is similar to that used for Base A. A "Sub-Base C" having a 24-inch vertical post is available for engraving tall work and long wide panels. 78

Moline Automatic Retracting Boring Head

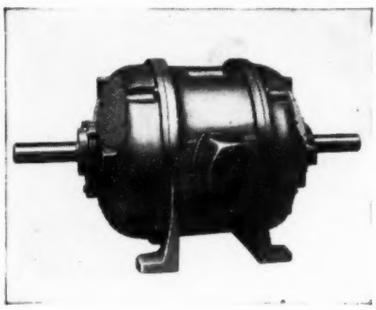
An automatic retracting boring head for producing precision bores with a single-point tungsten-carbide tool has been developed by the Moline Tool Co., Moline, Ill. This head has a number of advantages over the conventional type of boring head. It is especially adapted for finish-boring the cylinders of internal combustion engines, and when used for this purpose on a Moline cylinder boring machine in actual production work has produced bores that were well within a tolerance of 0.0005 inch for roundness and straightness. The accuracy obtained with this boring head makes it possible to eliminate reaming operations and to reduce the number of honing operations required.

With this boring head there is no necessity for stopping, reversing, or indexing the boring spindle or shifting the work to avoid scoring upon withdrawal of the tool. The lower part of the head has a very slight eccentric motion with respect to the upper part. Hence, when the cutter comes in contact with the work, it expands immediately to the pre-set size. When the bore is completed and the work offers no further resistance to the cutter, the eccentric motion is reversed, causing the lower portion of the head to resume its original position, with the tool retracted. The tool can be locked in the expanded position for making adjustments or for use as a conventional solid tool.

By turning the knob that controls the tool-setting stop 90 degrees to the right, the diameter of the bore is increased approximately 0.001 inch, and by turning the knob 90 degrees to the left the diameter is decreased a like amount. Thus a 0.002-inch adjustment of the diameter of the bore is obtained by a 180-degree movement of the adjustment knob. This knob is provided with fine notches and a spring lock which permits variations as small as 0.0001 inch on the diameter of the bore. 79



Moline Boring Head with Retracting Tool



Westinghouse Hoist Motor for Severe Intermittent Service

Westinghouse Squirrel-Cage Hoist Motors

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has just brought out a line of Type CS hoist motors designed for severe intermittent service where frequent starts, stops, and reversals are necessary. These motors are especially applicable for hoist service, and are also suitable for operating doors, gate valves, blast-furnace mud guns, and car spotters.

Ball or sealed-sleeve bearings can be furnished, designed especially to exclude dirt and foreign particles and to prevent loss of lubricant. These motors can also be built with special mounting brackets. 80

"Comparoscope" for Testing Surface Finishes

A portable comparative microscope for testing surface finishes, which is self-illuminating, self-focussing and self-aligning, has been brought out by the Higgins Tool Co., 2921 E. Grand Blvd., Detroit, Mich. This instrument can be used on round or flat specimens of any dimensions. It gives at a glance through the single eye-piece a clear magnified comparison of the work piece and standard, side by side.

This "Comparoscope" is particularly adapted for testing finishes on crankshafts, camshafts, wrist-pins, pistons, valves, tappets, etc. It can also be used for examining and comparing the sizes of abrasive grains and

To obtain additional information on equipment described on this page, see lower part of page 284.

their structure and spacing in grinding wheels and abrasive paper and abrasive cloth. The surface finishes on gages and the fractures caused by hardening can also be examined. 81

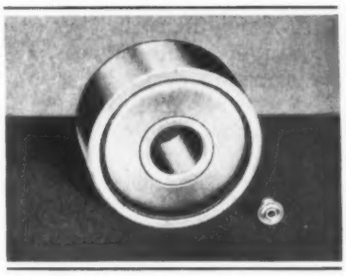
SKF Triple Seal for Bearing Protection

A patented triple seal for protecting bearings against lubricant leakage, dust, dirt, and moisture has been made available by SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa. This seal consists of two split piston-rings on each side of the bearing housing. Each ring has an inward tension that enables it to turn with the shaft. As the rings are not securely fastened to the shaft, the seals are free to move axially whenever shaft expansion occurs; consequently, close clearances are maintained between the rings and the housing. Any lubricant passing the first seal is returned to the housing.

This triple seal is made for the complete range of standard shaft sizes, and is designed for split housings which are machined to allow axial freedom of the bearing. When a bearing is to be stabilized, the same housing is used as for the floating bearing, the stabilizing being effected by one or two rings, depending on the width of the particular bearing used. A segment of the ring is removed, so that it can be slipped over the shaft and applied between the outer race of the bearing and the housing shoulder, thus avoiding the necessity for two different types of housings and enabling the user to stabilize or provide float for any of these bearings. 82

Fafnir Airplane Control Ball Bearings

The accompanying illustration shows the largest and the smallest standard ball bearings of the specialized aircraft bearing line made by the Fafnir Bearing Co., New Britain, Conn. This line of ball bearings now comprises nearly 100 different sizes. The large bearing shown in the illustration is the latest addition to this line.



Fafnir Ball Bearings for Airplane Control

Many of these bearings are located in almost inaccessible places within the aircraft structure, and hence cannot be reached for frequent servicing and replacing. It was therefore necessary to develop seals that were not only impervious to dust and dirt, but also to the salt spray encountered in seaplane operation, and also to pre-pack the bearings at the factory with a supply of lubricant sufficient to last indefinitely. 83

Lincoln Shield-Arc Welders

A line of Shield-Arc welders designed to provide greater convenience and accuracy through the use of a new self-indicating dual continuous control has been brought out by the Lincoln Electric Co., Cleveland, Ohio. These welders have both the job selector and the current control calibrated and equipped with dials that indicate the type of work and the number of amperes for every setting. It is claimed that this development enables the operator to obtain the highest quality welds and the highest

SKF Triple Seal Applied to Bearing Mounted in Housing Having Float Adjustment Rings

Lincoln Shield-Arc Welder Equipped with Alternating-current Motor Drive

To obtain additional information on equipment described on this page, see lower part of page 284.

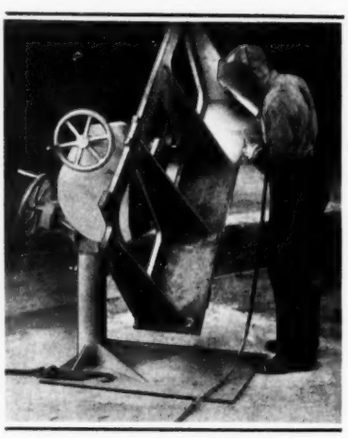
possible welding speeds, because he can vary the slope of the volt-ampere curve and the amount of welding current independently to suit each individual job.

Both the voltage control and current control are continuous in operation. This feature provides literally thousands of possible combinations of voltage and current, giving a wide welding range with respect to the type of work, welding conditions, electrode sizes, and thicknesses of material. This line of welders is available in alternating- and direct-current motor-driven types, belted or coupled models, and in gasoline-engine and Diesel-engine driven types in all standard ratings. 84

Cullen-Friestedt Welding Positioner

A welding positioner which allows the operator to weld on all sides, top, and bottom of a structure with only one set-up, has been developed by the Cullen-Friestedt Co., 1305 S. Kilbourn Ave., Chicago, Ill. The table of this positioner can be tilted through an arc of 135 degrees, so that all welds can be made in a horizontal position. The height is adjustable from 36 to 48 inches, and the table can be revolved through a full circle, regardless of the angular position at which it is tilted. It has a capacity of 2500 pounds with the center of gravity of the load 6 inches from the table.

The revolving and tilting movements are obtained by means of separate handwheels. The gears for revolving and tilting the table are self-locking, and the gears for revolving the table can be disengaged to permit the table to be revolved freely. 85

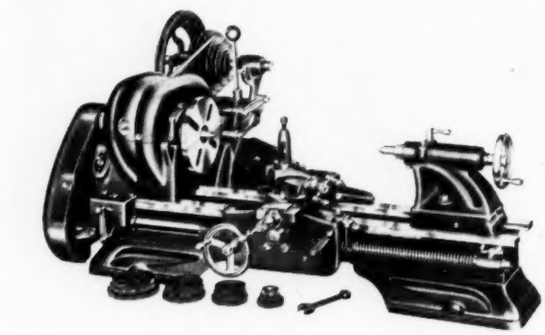


Welding Positioner Brought out by the Cullen-Friestedt Co.

"Add-A-Bin" for Storing Bolts and Screws

A compact means for storing screws, bolts, nuts, washers, etc., is provided by the "Add-A-Bin" equipment, recently brought out by the Noggle Products Co., Ann Arbor, Mich. This system of unit bins is sold separately and assembled by the user to suit his individual requirements. The bin housing can be screwed to a wall bench, or cupboard or to a panel which can be fashioned into a portable kit. A bin can be opened for the removal of a single item, and it is so delicately balanced that the weight of its contents, no matter how light, causes it to close automatically when the hand is removed. Provision is made for locking the bins in the open position.

The 3-inch bins are 2 1/2 inches deep, 3 inches high, and 3, 6, or 9 inches wide. The 4-inch bins are 3 inches deep and 4, 8, or 12 inches wide. 86



Atlas 10-inch Lathe with Power Cross-feed

Atlas Lathes with Power Cross-Feed

The Atlas Press Co., Kalamazoo, Mich., has brought out a power cross-feed mechanism that will be furnished as standard equipment with the company's new F series 10-inch lathes. Both the power cross-feed and the longitudinal feeds are instantly reversible. This lathe is equipped with custom-built spindle bearings and a complete V-belt drive. It has sixteen speeds, and is available with horizontal or vertical countershafts. Provision is made for cutting from 4 to 96 threads per inch. It is built in four bed lengths ranging from 36 to 54 inches. 87

General Electric Limit Switch and Starter

A new single-pole limit switch with a mercury-button contact mechanism for opening and closing the circuit has been placed on the market by the General Electric Co., Schenectady, N. Y. This new device is particularly suitable for use where the force available for operating the switch is small. The operating force required is only that necessary to lift a light-weight molded lever or arm, which is re-

Unit Bins which are Sold Separately for Assembly by User

To obtain additional information on equipment described on this page, see lower part of page 284.

turned to its lower position by its own weight.

The mercury-button unit is hermetically sealed with a glass ring to eliminate maintenance cost. Because of the tendency of the mercury to cohere, and its lack of adhesion to the insulating disk, a positive, quick break is assured. This switch must be mounted vertically.

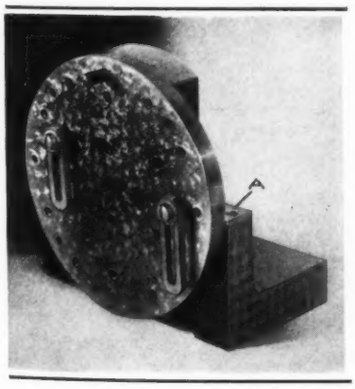
A magnetic switch for use with single-phase motors is another new product placed on the market by this company. This switch is available in ratings of 3 horsepower at 110 volts; 5 horsepower at 220 volts; and 7 1/2 horsepower at 440 volts. It is of the standard general-purpose four-pole type, with two poles connected in parallel. Its application is limited to single-phase motors whose normal full-load current does not exceed 30 amperes. 88

Pesco "Index Master"

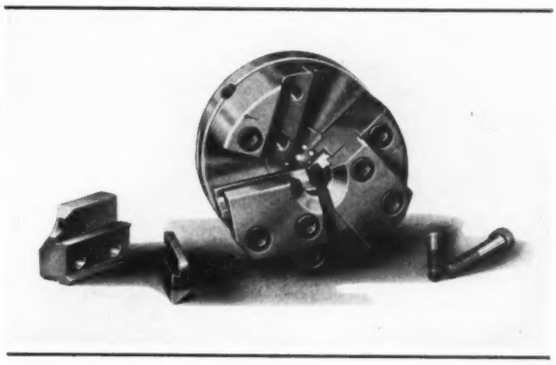
An instrument designated the "Index Master," for accurately laying out and checking angular work, has been placed on the market by the Pump Engineering Service Corporation, 12912 Taft Ave., Cleveland, Ohio, for use in tool-rooms and machine shops. The vertical index-plate of this instrument revolves on a bearing stud fitted in the center bushing of an angle-iron and can be clamped in any position. The outside rim of the index-plate is graduated in degrees. Eight index-holes with hardened, ground, and lapped bushings are located 45 degrees apart. These holes are all positioned the same distance from the center bushing and from each other.

The large easily read figures on the edge of the index-plate permit double checking of all angles. An index-pin inserted in any one of the index bushings, when resting on the guide plate *A* of the angle-iron, brings the index-plate into the exact 45-degree angular position. Settings for any other angle are made by using gage-blocks placed on either of the guide plates. When the index-pin comes in contact with the gage-blocks, the exact angular setting is obtained.

The numerous holes drilled and tapped in the face of the index-plate are used for clamping work. The device weighs 30 pounds. 89



Pesco "Index Master" for Laying out and Checking Angular Work



Special Forming Head for Use on the Landis Automatic Forming and Threading Machine

Forming Head for Landis Automatic Forming and Threading Machine

The Landis Machine Co., Inc., Waynesboro, Pa., has recently designed a special forming head for use on its automatic forming and threading machine. Heretofore the forming head used on this machine merely faced and beveled or "pointed" the end of the bolt or screw. The new head has two additional functions to perform. In addition to facing and beveling the end of the work, the cutters used in this head are designed to reduce the body diameter of the work and face a shoulder at the end of the cut.

In order to reduce the strain on the head, the cutting load is distributed over three cutters. The cutters are located and securely held in the correct cutting position by a setting gage and a clamping action similar to that employed for the Landis tangential chaser. Provision is also made for the independent adjustment of each cutter-holder, so that uniform cutting is assured. 90

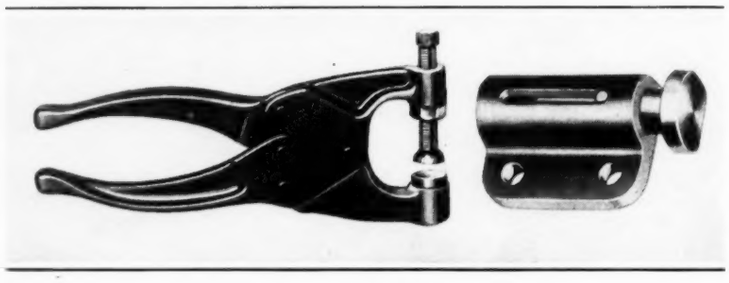
"Saco" Speed Reducers

The Stephens-Adamson Mfg. Co., Aurora, Ill., is now building, in addition to its line of JFS variable-speed reducers, a new line of constant-speed reducers which are to be sold under the trade name "Saco." These speed reducers can be used with any standard full-speed motor to give the required output speed.

The motor support is adjustable for V-belt drive, permitting sheaves to be easily replaced to suit changes in the required out-

"Saco" Constant-speed Reducer with V-belt Drive

To obtain additional information on equipment described on this page, see lower part of page 284.



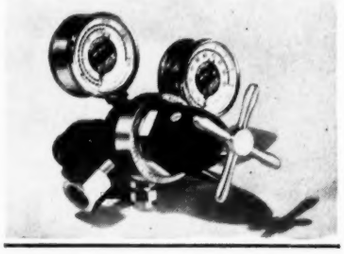
Knu-Vise Toggle Pliers and Spring Stop-gage

put speed. The shaft support is constructed to permit heavy over-hung loads. The output speeds vary from 13.2 to 172 revolutions per minute. All shafts are mounted in precision ball bearings, and the precision cut helical steel gears operate in a constant bath of oil. 91

Linde Two-Stage Regulators and Cutting Attachment

The Linde Air Products Co., 205 E. 42nd St., New York City, has brought out two new "Purox" oxygen regulators—the Type R-201 for ordinary welding and light cutting, and the Type R-202 for heavy-duty cutting—as well as a "Purox" acetylene regulator, Type R-203. These regulators are of the two-stage type. A fixed "first stage" reduces the pressure of the oxygen or acetylene from cylinder pressure to a moderate pressure, below which it is controlled by the variable second-stage of regulation. Stem type valve mechanisms insure a uniform flow of oxygen and acetylene at the low pressures at which the gases are used and in quantities sufficient for all welding and cutting operations. The Monel metal valve stems, being separate from the diaphragms, eliminate stem distortion due to diaphragm pull caused by leakage.

A new oxy-acetylene cutting attachment has also been developed by the same company for use in shops where the amount of cutting does not justify the purchase of a separate cutting blowpipe, and for those operations in the field where incidental cutting is done or where a minimum of equipment is desired. This new cutting attachment, known as Type CW-23, will cut any thickness of steel up to 8 inches. An improved injector principle makes possible exceptionally accurate control of gases, so that the attachment performs equally well with low-pressure or medium-pressure acetylene. This attachment can be used with either W-17 or W-22 Oxweld welding blowpipes for cutting steel, wrought iron, and cast iron. 92



"Purox" Oxygen Regulator for Welding and Light Cutting

Toggle Pliers and Spring Stop-Gage

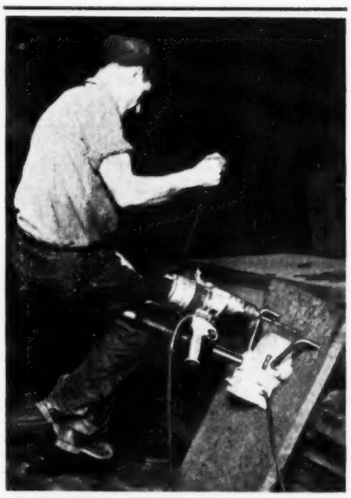
The Knu-Vise Products Co., 6426 Cass Ave., Detroit, Mich., has just placed on the market the Knu-Lok toggle pliers, shown to the left in the accompanying illustration, which serve as a C-clamp for holding two pieces of material in close contact. The lever arrangement develops sufficient pressure to permit the pliers to be used in cold-heading rivets, bell-mouthing tubes, forming and bending metal, spot-welding, templet making, etc. The pressure exerted by simply squeezing the handles can be adjusted by means of a screw in one of the jaws.

The spring stop-gage shown to the right in the illustration has been developed for tool-room use on dies, fixtures, and gages to compensate for variations in the widths of castings, sheet-metal strip when fed to progressive dies, formed stampings, etc. 93

Stearns Magnet for Portable Drill Stands

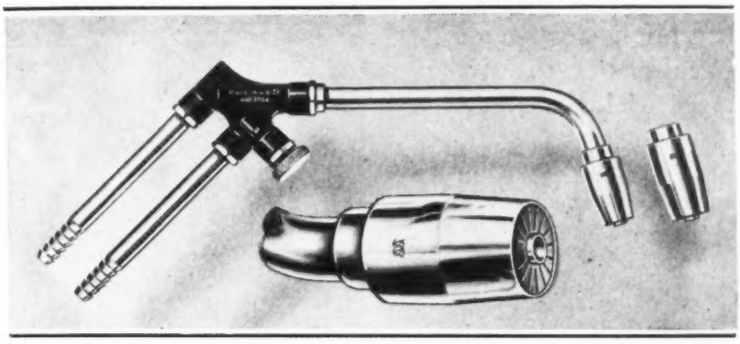
In response to the demand for a powerful, yet small and light magnet that can be attached to the average type of drill stand, the Stearns Magnetic Mfg. Co., Milwaukee, Wis., has designed the high-duty portable drill stand magnet shown at the right of the drill in the illustration. This new magnet is designed to increase the usefulness of the drill stand by permitting the unit to be readily conveyed and spotted in almost any conceivable position for drilling, tapping, reaming, hole sawing, nut running, or similar operations.

With this magnet arrangement, the drill can be operated horizontally, vertically, upside down, or at almost any angle. It allows full visibility of the tool



Portable Drill Equipped with Stearns Magnet

To obtain additional information on equipment described on this page, see lower part of page 284.



S. S. White Blowpipe for General-purpose Soldering and Brazing

Blowpipe for Soldering and Brazing

The S. S. White Dental Mfg. Co., Industrial Division, 10 E. 40th St., New York City, has recently placed on the market a No. 8 high-intensity gas and air torch or blowpipe for general-purpose soldering, brazing, etc. This torch has a number of novel features which have been developed to give it high efficiency and to facilitate its use.

Two interchangeable tips are available. The smaller tip, supplied as standard equipment, is suitable for all ordinary soldering and brazing operations. Its flame can be held to a fine needle-point or increased to a strong blast. The larger tip is for use where large quantities of alloys must be melted rapidly.....97

and can be used on the center, edges, or any part of the material. The portable drill stand magnet weighs 40 pounds and has a pull of 900 pounds. The magnet is 8 1/2 inches in diameter. It can be used on alternating or direct current.....94

Fafnir Ball Bearings for Woodworking Machines

A line of high-speed ball bearings for woodworking machinery has been developed by the Fafnir Bearing Co., New Britain, Conn., to enable machine spindles to be kept rigidly aligned and free from vibration and chatter. These bearings are made in two types—one having a machined bronze retainer, and the other, made in Duplex pairs, having a composition retainer.

The large size balls and deep races of these bearings provide for high load capacity and shock resistance. The accurate preload characteristics of the Duplex type bearing, when these bearings are mounted in pairs at each end of a spindle, completely eliminate radial chatter.....95

H & G Insert-Chaser Die-Head

A new style of H & G insert-chaser die-head for use on hand screw machines and turret lathes has been developed by the Eastern Machine Screw Corporation, 23-43 Barclay St., New Haven, Conn. This new head uses the same chasers as other styles, and is made in what are known as 101, 102, and 103 sizes, the latter size having a range of from 1/4- up to 1 1/4-inch threads in long threads, and up to 1 1/2 inches in short threads. All three sizes

H & G Die-head which will Thread Work of Any Length

of heads use the same chasers where the sizes are within their rated capacities.

The drive is by torque arms located at a maximum distance from the center. The head can be tripped either by pull-off or by front-end contact, the latter being especially adapted for close-to-shoulder threading or for cutting extremely short threads. Fine adjustment for length of thread is provided. The shank of the head is detachable and can be furnished in various diameters. A clearance hole through the shank makes it possible to cut any length of thread in diameters up to the normal capacity of the die-head The head also has longitudinal float which compensates for variations in starting pressure or turret travel. 96

Dayton Rogers Pneumatic Die Cushion

The Dayton Rogers Mfg. Co., 2830 S. 13th Ave., Minneapolis, Minn., has brought out a Model B universal pneumatic die cushion, made in seven sizes with piston diameters from 4 to 14 inches. This die cushion has a hollow stem which allows the scrap slugs to fall through the cushion cylinder, thus making the design adapted for combina-

Dayton Rogers Pneumatic Die Cushion

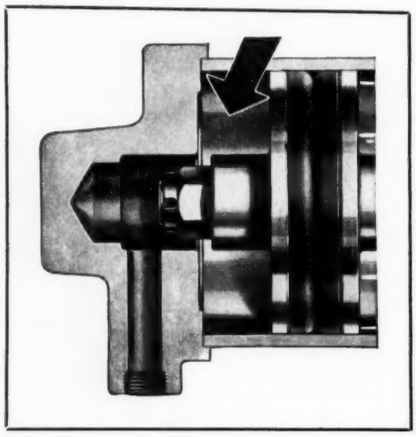
To obtain additional information on equipment described on this page, see lower part of page 284.

tion blanking, drawing, and piercing dies, as well as for stripper control action on all compound blanking and piercing dies. Each cushion is supplied complete, with a reducing regulator control valve and pressure gage. 98

Nopak Cushioned Air Cylinders

A complete line of air cylinders with cushion heads has recently been developed by the Galland-Henning Mfg. Co., S. 31st St., Milwaukee, Wis., to eliminate noisy and destructive metal-to-metal impact. The advantages claimed for these cushioned air cylinders are longer life, smoother and more efficient operation, and lower maintenance costs for all air-powered equipment.

This Nopak line of air cylinders is made with adjustable or non-adjustable cushion heads, as desired. These air cylinders are built in five models, with any desired length of stroke. The Model A cylinders are furnished for horizontal base mounting; the Model B for horizontal center line mounting; the Model C for vertical flat top mounting; the Model D for vertical flat base mounting; and the Model E for pendulum mounting. All five models are made in seven sizes with cylinder diameters ranging from 2 to 12 inches, and for air pressures up to 150 pounds per square inch. 99

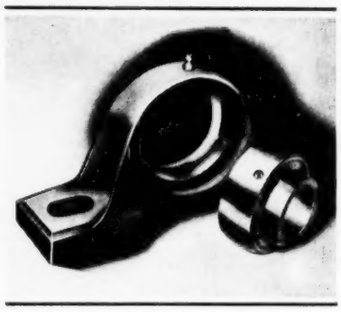


Cushioned End of Nopak Air Cylinder

Stephens-Adamson Sealmaster Pillow Blocks

A line of permanently sealed pre-lubricated self-aligning ball-bearing pillow blocks for general machinery use, known as Sealmaster, has been brought out by the Stephens-Adamson Mfg. Co., Aurora, Ill. A positive centrifugal sealing principle is employed in these bearings to obtain a permanent seal. For special service, expansion bearings can be furnished in place of the non-expansion type.

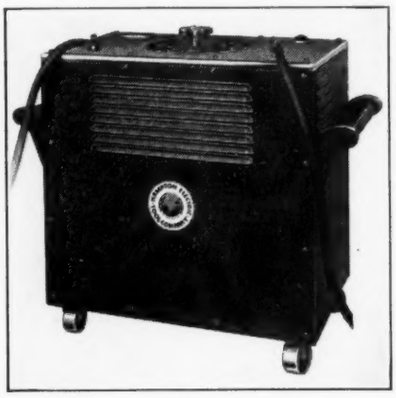
These pillow blocks are made in three types, designated as normal duty, standard duty, and



Stephens-Adamson Permanently Sealed Ball-bearing Pillow Blocks

medium heavy duty. The normal-duty pillow blocks are adapted for constant loads at normal speeds and light shock loads. They are made in sizes for shafts ranging from 7/8 inch up to 2 3/16 inches in diameter.

The standard-duty pillow blocks are recommended for any average general machinery requirements, and are made in sizes to accommodate shafts from 7/8 inch up to 2 15/16 inches in diameter. The medium heavy-duty pillow blocks are adapted for heavy loads and for use where press fits are required. This type is made in sizes for shafts from 1 3/16 inches up to 2 11/16 inches in diameter. 100



Electric Welding Machine Brought out by the Hampton Electric Tool Co.

Hampton Alternating-Current Electric Welder

A Model E alternating-current electric welder has recently been brought out by the Hampton Electric Tool Co., 700 Walnut St., Edgewood, Pittsburgh, Pa. The features of this welder include a welding range of 20 to 280 amperes, using any size electrode from 1/16 to 1/4 inch; single dial control for instant choice of the proper welding amperage for the job; operation on any standard 110- or 220-volt alternating current; adapted for operation on either 110- or 220-volt currents by simply changing the position of a copper bar; portable and easily stored, being only 20 by 13 by 23 inches in size. 101

* * *

Course in English for Engineers

The Pratt Institute of Brooklyn, N. Y., has started an evening course in the writing of technical articles and engineering reports, which is intended to give the students an advanced course in the principles of good technical writing. During the course, each student writes a technical article and an engineering report which are presented and discussed in the classroom. It would be very useful to engineering students if more schools stressed the writing of good English.

To obtain additional information on equipment described on this page, see lower part of page 284.